

# DaimlerChrysler Corporation

## SERVICE MANUAL

### 2000 SEBRING CONVERTIBLE

To order the special service tools used and illustrated, please refer to the instructions on inside back cover.



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## FOREWORD

The information contained in this service manual has been prepared for the professional automotive technician involved in daily repair operations. Information describing the operation and use of standard and optional equipment is included in the Owner's Manual provided with the vehicle.

Information in this manual is divided into groups. These groups contain general information, diagnosis, testing, adjustments, removal, installation, disassembly, and assembly procedures for the systems and components. To assist in locating a group title page, use the Group Tab Locator on the following page. The solid bar after the group title is aligned to a solid tab on the first page of each group. The first page of the group has a contents section that lists major topics within the group. If you are not sure which Group contains the information you need, look up the Component/System in the alphabetical index located in the rear of this manual.

A Service Manual Comment form is included at the rear of this manual. Use the form to provide DaimlerChrysler Corporation with your comments and suggestions.

Tightening torques are provided as a specific value throughout this manual. This value represents the midpoint of the acceptable engineering torque range for a given fastener application. These torque values are intended for use in service assembly and installation procedures using the correct OEM fasteners. When replacing fasteners, always use the same type (part number) fastener as removed.

DaimlerChrysler Corporation reserves the right to change testing procedures, specifications, diagnosis, repair methods, or vehicle wiring at any time without prior notice or incurring obligation.

Navigation Tools: Click on the "Table of Contents" below, or use the Bookmarks to the left.

## GROUP TAB LOCATOR

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<b>8O</b>	Power Distribution Systems	
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Service Manual Comment Forms

(Rear of Manual)

# INTRODUCTION

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## DESCRIPTION AND OPERATION

### VEHICLE SAFETY CERTIFICATION LABEL

#### DESCRIPTION

A vehicle safety certification label is attached to the left side of B-pillar or on the rearward facing of the front door (Fig. 1). This label indicates date of manufacture (month and year), Gross Vehicle Weight Rating (GVWR), Gross Axle Weight Rating (GAWR) front, Gross Axle Weight Rating (GAWR) rear and the Vehicle Identification Number (VIN). The Month, Day and Hour of manufacture is also included.

All communications or inquiries regarding the vehicle should include the Month-Day-Hour and Vehicle Identification Number.

MFD BY CHRYSLER CORPORATION		DATE OF MFR: XX-XX	
GVWR 04112 LB	GAWR 2305 LB	GAWR 1882 LB	
1866 KG	FRONT 1046 KG	REAR 0854 KG	
THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY, BUMPER AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.			
VIN: XXXXXXXXXXXXXXXX		TYPE: XXXXXXXX	
			
MDH: XXXXXX XX PAINT:XXX VEHICLE MADE IN U.S.A. TRIM:XXXX			

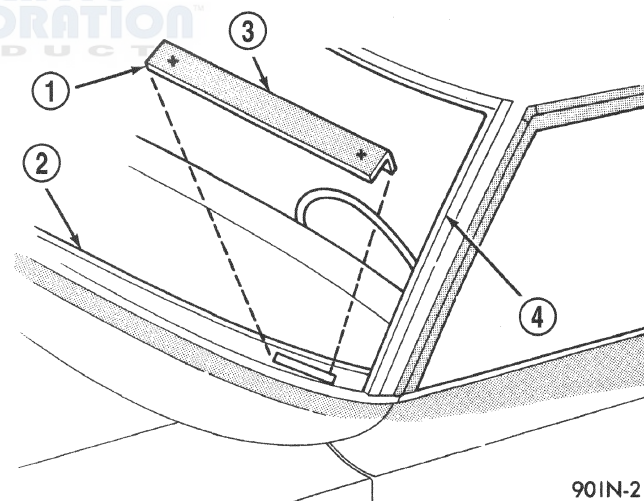
800dfad9

**Fig. 1 Vehicle Safety Certification Label**

### VEHICLE IDENTIFICATION NUMBER

#### DESCRIPTION

The Vehicle Identification Number (VIN) is located on the upper left corner of the instrument panel, near the left windshield pillar (Fig. 2). The VIN consists of 17 characters in a combination of letters and numbers that provide specific information about the vehicle. Refer to VIN Code Breakdown table for decoding information.



**Fig. 2 Vehicle Identification Number (VIN Plate)**

- 1 - V. I. N. PLATE
- 2 - DASH PANEL
- 3 - 17 DIGITS
- 4 - WINDSHIELD OPENING



**DESCRIPTION AND OPERATION (Continued)****VIN CODE BREAKDOWN**

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	3 = Built in Mexico by Chrysler of Mexico
2	Make	C = Chrysler
3	Vehicle Type	3 = Passenger Car
4	Passenger Safety	E = Active Driver and Passenger Air Bag
5	Car Line	L = Chrysler, Sebring
6	Series	4 = High line 5 = Premium
7	Body Style	5 = Convertible/Open Body
8	Engines	H = 2.5 L 6 Cyl Gasoline SOHC
9	Check Digit	0 through 9 or X
10	Model Year	Y = 2000
11	Plant	T = Toluca
12 through 17	Sequence Number	6 digit number assigned by assembly plant.

**VIN CHECK DIGIT****DESCRIPTION**

To protect the consumer from theft and possible fraud the manufacturer is required to include a Check Digit at the ninth position of the Vehicle Identification Number. The check digit is used by the manufacturer and government agencies to verify the authenticity of the vehicle and official documentation. The formula to use the check digit is not released to the general public.

**BODY CODE PLATE****DESCRIPTION****LOCATION AND DECODING**

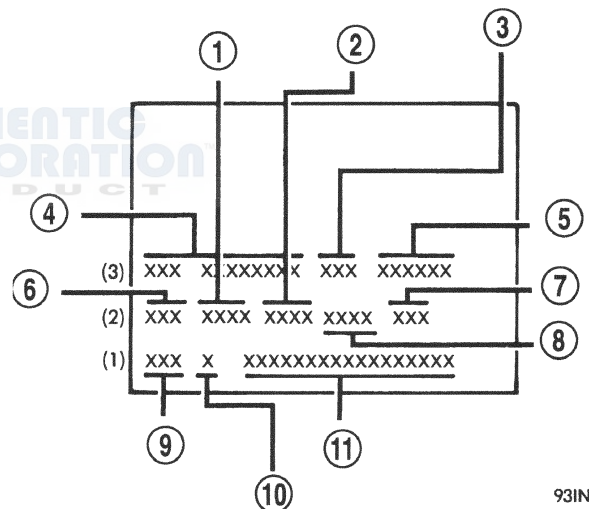
The Body Code Plate (Fig. 3) is located in the engine compartment on the driver side strut tower. There are seven lines of information on the body code plate. Lines 4, 5, 6, and 7 are not used to define service information. Information reads from left to right, starting with line 3 in the center of the plate to line 1 at the bottom of the plate.

**BODY CODE PLATE LINE 3****DIGITS 1, 2, AND 3**

Paint procedure

**DIGIT 4**

Open Space



93IN-8

**Fig. 3 Body Code Plate**

- 1 - PRIMARY PAINT
- 2 - SECONDARY PAINT
- 3 - VINYL ROOF
- 4 - VEHICLE ORDER NUMBER
- 5 - CAR LINE SHELL
- 6 - PAINT PROCEDURE
- 7 - ENGINE
- 8 - TRIM
- 9 - TRANSMISSION
- 10 - MARKET
- 11 - VIN

**DIGITS 5 THROUGH 7**

Primary paint  
See Group 23, Body for color codes.



**DESCRIPTION AND OPERATION (Continued)****DIGIT 8 AND 9**

Open Space

**DIGITS 10 THROUGH 12**

Secondary Paint

**DIGIT 13 AND 14**

Open Space

**DIGITS 15 THROUGH 18**

Interior Trim Code

**DIGIT 19**

Open Space

**DIGITS 20, 21, AND 22**

Engine Code

- EEB = 2.5L Six Cylinder SOHC Gasoline
- EDZ = 2.4L Four Cylinder DOHC Gasoline

**DIGIT 23**

Open Space

**BODY CODE PLATE – LINE 2****DIGITS 1 THROUGH 12**

Vehicle Order Number

**DIGITS 13 THROUGH 17**

Open Space

**DIGITS 18 AND 19**

Vehicle Shell Line

- JX

**DIGIT 20**

Carline

- C = Chrysler

**DIGIT 21**

Price Class

- E = Economy
- H = High Line
- L = Low Line
- M = Mid Line
- P = Premium
- S = Special/Sport
- X = Performance Image

**DIGITS 22 AND 23**

Body Type

- 27 = 2 Door Convertible

**BODY CODE PLATE LINE 1****DIGITS 1, 2, AND 3**

Transaxle Codes

- DGL = 41TE 4-speed Electronic Automatic Transaxle

**DIGIT 4**

Open Space

**DIGIT 5**

Market Code

- B = International
- C = Canada
- M = Mexico
- U = United States

**DIGIT 6**

Open Space

**DIGITS 7 THROUGH 23**

Vehicle Identification Number

- Refer to Vehicle Identification Number (VIN) paragraph for proper breakdown of VIN code.

**IF TWO BODY CODE PLATES ARE REQUIRED**

The last code shown on either plate will be followed by END. When two plates are required, the last code space on the first plate will indicate (CTD)

When a second plate is required, the first four spaces of each line will not be used due to overlap of the plates.

























**INTERNATIONAL SYMBOLS**

The graphic symbols illustrated in the following International Control and Display Symbols chart are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.

**FASTENER IDENTIFICATION****DESCRIPTION****GRADE/CLASS IDENTIFICATION**

The SAE bolt strength grades range from grade 2 to grade 8. The higher the grade number, the greater the bolt strength. Identification is determined by the line marks on the top of each bolt head. The actual bolt strength grade corresponds to the number of line marks plus 2. The most commonly used metric bolt strength classes are 9.8 and 10.9. The metric strength class identification number is imprinted on the head of the bolt. The higher the class number, the greater the bolt strength. Some metric nuts are imprinted with a single-digit strength class on the nut face. Refer to the Fastener Identification and Fastener Strength Charts.

**DESCRIPTION AND OPERATION (Continued)**

					
1	2	3	4	5	6
					
7	8	9	10	11	12
					
13	14	15	16	17	18
					
19	20	21	22	23	24

80bdbd36

1	High Beam	13	Rear Window Washer
2	Fog Lamps	14	Fuel
3	Headlamp, Parking Lamps, Panel Lamps	15	Engine Coolant Temperature
4	Turn Warning	16	Battery Charging Condition
5	Hazard Warning	17	Engine Oil
6	Windshield Washer	18	Seat Belt
7	Windshield Wiper	19	Brake Failure
8	Windshield Wiper and Washer	20	Parking Brake
9	Windscreen Demisting and Defrosting	21	Front Hood
10	Ventilating Fan	22	Rear hood (Decklid)
11	Rear Window Defogger	23	Horn
12	Rear Window Wiper	24	Lighter

**FASTENER USAGE****DESCRIPTION**

**WARNING: USE OF AN INCORRECT FASTENER MAY RESULT IN COMPONENT DAMAGE OR PERSONAL INJURY.**

Figure art, specifications and tightening torque references in this manual are identified in metric and SAE format.

During any maintenance or repair procedures, it is important to salvage all fasteners (nuts, bolts, etc.) for reassembly. If the fastener is not salvageable, a fastener of equivalent specification must be use.

**THREADED HOLE REPAIR****DESCRIPTION**

Most stripped threaded holes can be repaired using a Helicoil<sup>®</sup>. Follow the manufacture recommendation for application and repair procedures.

**METRIC SYSTEM****DESCRIPTION**

The metric system is based on quantities of one, ten, one hundred, one thousand and one million.

The following chart will assist in converting metric units to equivalent English and SAE units, or vise versa.

## DESCRIPTION AND OPERATION (Continued)

## FASTENER IDENTIFICATION

## Bolt Markings and Torque - Metric

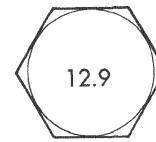
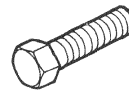
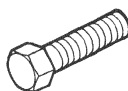
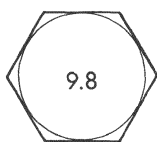
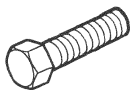
Commercial Steel Class

9.8

10.9

12.9

Bolt Head Markings



Body Size Diam. mm	Torque				Torque				Torque			
	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	14	9	11	7	14	9	11	7
7	14	9	11	7	18	14	14	11	23	18	18	14
8	25	18	18	14	32	23	25	18	36	27	28	21
10	40	30	30	25	60	45	45	35	70	50	55	40
12	70	55	55	40	105	75	80	60	125	95	100	75
14	115	85	90	65	160	120	125	95	195	145	150	110
16	180	130	140	100	240	175	190	135	290	210	220	165
18	230	170	180	135	320	240	250	185	400	290	310	230

## Bolt Markings and Torque Values - U.S. Customary

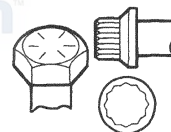
SAE Grade Number

5

8

Bolt Head Markings

These are all SAE Grade 5 (3) line


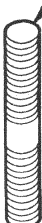






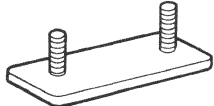



## Bolt Torque - Grade 5 Bolt

## Bolt Torque - Grade 8 Bolt

Body Size	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	12	9
- 28	12	9	9	7	18	13	14	10
5/16 - 18	20	15	16	12	30	22	24	18
- 24	23	17	19	14	33	24	25	19
3/8 - 16	40	30	25	20	55	40	40	30
- 24	40	30	35	25	60	45	45	35
7/16 - 14	60	45	45	35	90	65	65	50
- 20	65	50	55	40	95	70	75	55
1/2 - 13	95	70	75	55	130	95	100	75
- 20	100	75	80	60	150	110	120	90
9/16 - 12	135	100	110	80	190	140	150	110
- 18	150	110	115	85	210	155	170	125
5/8 - 11	180	135	150	110	255	190	205	150
- 18	210	155	160	120	290	215	230	170
3/4 - 10	325	240	255	190	460	340	365	270
- 16	365	270	285	210	515	380	410	300
7/8 - 9	490	360	380	280	745	550	600	440
- 14	530	390	420	310	825	610	660	490
1 - 8	720	530	570	420	1100	820	890	660
- 14	800	590	650	480	1200	890	960	710

**DESCRIPTION AND OPERATION (Continued)****FASTENER STRENGTH****HOW TO DETERMINE BOLT STRENGTH**

	Mark	Class		Mark	Class
Hexagon head bolt	 Bolt head No. 4 — 4T 5 — 5T 6 — 6T 7 — 7T 8 — 8T 9 — 9T 10 — 10T 11 — 11T		Stud bolt	 No mark 4T	
	 No mark 4T				
Hexagon flange bolt w/washer hexagon bolt	 No mark 4T			 Grooved 6T	
Hexagon head bolt	 Two protruding lines 5T				
Hexagon flange bolt w/washer hexagon bolt	 Two protruding lines 6T		Welded bolt		
Hexagon head bolt	 Three protruding lines 7T			 4T	
Hexagon head bolt	 Four protruding lines 8T				



**DESCRIPTION AND OPERATION (Continued)****CONVERSION FORMULAS AND EQUIVALENT VALUES**

MULTIPLY	BY	TO GET	MULTIPLY	BY	TO GET
in-lbs	x 0.11298	= Newton Meters (N·m)	N·m	x 8.851	= in-lbs
ft-lbs	x 1.3558	= Newton Meters (N·m)	N·m	x 0.7376	= ft-lbs
Inches Hg (60° F)	x 3.377	= Kilopascals (kPa)	kPa	x 0.2961	= Inches Hg
psi	x 6.895	= Kilopascals (kPa)	kPa	x 0.145	= psi
Inches	x 25.4	= Millimeters (mm)	mm	x 0.03937	= Inches
Feet	x 0.3048	= Meters (M)	M	x 3.281	= Feet
Yards	x 0.9144	= Meters	M	x 1.0936	= Yards
mph	x 1.6093	= Kilometers/Hr. (Km/h)	Km/h	x 0.6214	= mph
Feet/Sec	x 0.3048	= Meters/Sec (M/S)	M/S	x 3.281	= Feet/Sec
mph	x 0.4470	= Meters/Sec (M/S)	M/S	x 2.237	= mph
Kilometers/ Hr. (Km/h)	x 0.27778	= Meters/Sec (M/S)	M/S	x 3.600	Kilometers/Hr. (Km/h)

**COMMON METRIC EQUIVALENTS**

1 inch = 25 Millimeters	1 Cubic Inch = 16 Cubic Centimeters
1 Foot = 0.3 Meter	1 Cubic Foot = 0.03 Cubic Meter
1 Yard = 0.9 Meter	1 Cubic Yard = 0.8 Cubic Meter
1 Mile = 1.6 Kilometers	

Refer to the Metric Conversion Chart to convert torque values listed in metric Newton- meters (N·m). Also, use the chart to convert between millimeters (mm) and inches (in.)

**TORQUE REFERENCES****DESCRIPTION**

Individual Torque Charts appear at the end of many Groups. Refer to the Standard Torque Specifications Chart for torque references not listed in the individual torque charts.

## DESCRIPTION AND OPERATION (Continued)

## METRIC CONVERSION

in-lbs to N•m

N•m to in-lbs

in- lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m	in-lb	N•m
2	.2260	42	4.7453	82	9.2646	122	13.7839	162	18.3032	.2	1.7702	4.2	37.1747	8.2	72.5792	12.2	107.9837	16.2	143.3882	
4	.4519	44	4.9713	84	9.4906	124	14.0099	164	18.5292	.4	3.5404	4.4	38.9449	8.4	74.3494	12.4	109.7539	16.4	145.1584	
6	.6779	46	5.1972	86	9.7165	126	14.2359	166	18.7552	.6	5.3107	4.6	40.7152	8.6	76.1197	12.6	111.5242	16.6	146.9287	
8	.9039	48	5.4232	88	9.9425	128	14.4618	168	18.9811	.8	7.0809	4.8	42.4854	8.8	77.8899	12.8	113.2944	16.8	148.6989	
10	1.1298	50	5.6492	90	10.1685	130	14.6878	170	19.2071	1	8.8511	5	44.2556	9	79.6601	13	115.0646	17	150.4691	
12	1.3558	52	5.8751	92	10.3944	132	14.9138	172	19.4331	1.2	10.6213	5.2	46.0258	9.2	81.4303	13.2	116.8348	17.2	152.2393	
14	1.5818	54	6.1011	94	10.6204	134	15.1397	174	19.6590	1.4	12.3916	5.4	47.7961	9.4	83.2006	13.4	118.6051	17.4	154.0096	
16	1.8077	56	6.3270	96	10.8464	136	15.3657	176	19.8850	1.6	14.1618	5.6	49.5663	9.6	84.9708	13.6	120.3753	17.6	155.7798	
18	2.0337	58	6.5530	98	11.0723	138	15.5917	178	20.1110	1.8	15.9320	5.8	51.3365	9.8	86.7410	13.8	122.1455	17.8	157.5500	
20	2.2597	60	6.7790	100	11.2983	140	15.8176	180	20.3369	2	17.7022	6	53.1067	10	88.5112	14	123.9157	18	159.3202	
22	2.4856	62	7.0049	102	11.5243	142	16.0436	182	20.5629	2.2	19.4725	6.2	54.8770	10.2	90.2815	14.2	125.6860	18.2	161.0907	
24	2.7116	64	7.2309	104	11.7502	144	16.2696	184	20.7889	2.4	21.2427	6.4	56.6472	10.4	92.0517	14.4	127.4562	19	168.1714	
26	2.9376	66	7.4569	106	11.9762	146	16.4955	186	21.0148	2.6	23.0129	6.6	58.4174	10.6	93.8219	14.6	129.2264	19.5	172.5970	
28	3.1635	68	7.6828	108	12.2022	148	16.7215	188	21.2408	2.8	24.7831	6.8	60.1876	10.8	95.5921	14.8	130.9966	20	177.0225	
30	3.3895	70	7.9088	110	12.4281	150	16.9475	190	21.4668	3	26.5534	7	61.9579	11	97.3624	15	132.7669	20.5	181.4480	
32	3.6155	72	8.1348	112	12.6541	152	17.1734	192	21.6927	3.2	28.3236	7.2	63.7281	11.2	99.1326	15.2	134.5371	21	185.8736	
34	3.8414	74	8.3607	114	12.8801	154	17.3994	194	21.9187	3.4	30.0938	7.4	65.4983	11.4	100.9028	15.4	136.3073	22	194.7247	
36	4.0674	76	8.5867	116	13.1060	156	17.6253	196	22.1447	3.6	31.8640	7.6	67.2685	11.6	102.6730	15.6	138.0775	23	203.5759	
38	4.2934	78	8.8127	118	13.3320	158	17.8513	198	22.3706	3.8	33.6342	7.8	69.0388	11.8	104.4433	15.8	139.8478	24	212.4270	
40	4.5193	80	9.0386	120	13.5580	160	18.0773	200	22.5966	4	35.4045	8	70.8090	12	106.2135	16	141.6180	25	221.2781	

ft-lbs to N•m

N•m to ft-lbs

ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m
1	1.3558	21	28.4722	41	55.5885	61	82.7049	81	109.8212	1	.7376	21	15.9888	41	30.2400	61	44.9913	81	59.7425	
2	2.7116	22	29.8280	42	56.9444	62	84.0607	82	111.1770	2	1.4751	22	16.2264	42	30.9776	62	45.7289	82	60.4801	
3	4.0675	23	31.1838	43	58.3002	63	85.4165	83	112.5328	3	2.2127	23	16.9639	43	31.7152	63	46.4664	83	61.2177	
4	5.4233	24	32.5396	44	59.6560	64	86.7723	84	113.8886	4	2.9502	24	17.7015	44	32.4527	64	47.2040	84	61.9552	
5	6.7791	25	33.8954	45	61.0118	65	88.1281	85	115.2446	5	3.6878	25	18.4391	45	33.1903	65	47.9415	85	62.6928	
6	8.1349	26	35.2513	46	62.3676	66	89.4840	86	116.6004	6	4.4254	26	19.1766	46	33.9279	66	48.6791	86	63.4303	
7	9.4907	27	36.6071	47	63.7234	67	90.8398	87	117.9562	7	5.1629	27	19.9142	47	34.6654	67	49.4167	87	64.1679	
8	10.8465	28	37.9629	48	65.0793	68	92.1956	88	119.3120	8	5.9005	28	20.6517	48	35.4030	68	50.1542	88	64.9545	
9	12.2024	29	39.3187	49	66.4351	69	93.5514	89	120.6678	9	6.6381	29	21.3893	49	36.1405	69	50.8918	89	65.6430	
10	13.5582	30	40.6745	50	67.7909	70	94.9073	90	122.0236	10	7.3756	30	22.1269	50	36.8781	70	51.6293	90	66.3806	
11	14.9140	31	42.0304	51	69.1467	71	96.2631	91	123.3794	11	8.1132	31	22.8644	51	37.6157	71	52.3669	91	67.1181	
12	16.2698	32	43.3862	52	70.5025	72	97.6189	92	124.7352	12	8.8507	32	23.6020	52	38.3532	72	53.1045	92	67.8557	
13	17.6256	33	44.7420	53	71.8583	73	98.9747	93	126.0910	13	9.5883	33	24.3395	53	39.0908	73	53.8420	93	68.5933	
14	18.9815	34	46.0978	54	73.2142	74	100.3316	94	127.4468	14	10.3259	34	25.0771	54	39.8284	74	54.5720	94	69.3308	
15	20.3373	35	47.4536	55	74.5700	75	101.6862	95	128.8026	15	11.0634	35	25.8147	55	40.5659	75	55.3172	95	70.0684	
16	21.6931	36	48.8094	56	75.9258	76	103.0422	96	130.1586	16	11.8010	36	26.5522	56	41.3035	76	56.0547	96	70.8060	
17	23.0489	37	50.1653	57	77.2816	77	104.3980	97	131.5144	17	12.5386	37	27.2898	57	42.0410	77	56.7923	97	71.5435	
18	24.4047	38	51.5211	58	78.6374	78	105.7538	98	132.8702	18	13.2761	38	28.0274	58	42.7786	78	57.5298	98	72.2811	
19	25.7605	39	52.8769	59	79.9933	79	107.1196	99	134.2260	19	14.0137	39	28.7649	59	43.5162	79	58.2674	99	73.0187	
20	27.1164	40	54.2327	60	81.3491	80	108.4654	100	135.5820	20	14.7512	40	29.5025	60	44.2537	80	59.0050	100	73.7562	

in. to mm

mm to in.

in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
.01	.254	.21	5.334	.41	10.414	.61	15.494	.81	20.574	.01	.00039	.21	.00827	.41	.01614	.61	.02402	.81	.03189	
.02	.508	.22	5.588	.42	10.668	.62	15.748	.82	20.828	.02	.00079	.22	.00866	.42	.01654	.62	.02441	.82	.03228	
.03	.762	.23	5.842	.43	10.922	.63	16.002	.83	21.082	.03	.00118	.23	.00906	.43	.01693	.63	.02480	.83	.03268	
.04	1.016	.24	6.096	.44	11.176	.64	16.256	.84	21.336	.04	.00157	.24	.00945	.44	.01732	.64	.02520	.84	.03307	
.05	1.270	.25	6.350	.45	11.430	.65	16.510	.85	21.590	.05	.00197	.25	.00984	.45	.01772	.65	.02559	.85	.03346	
.06	1.524	.26	6.604	.46	11.684	.66	16.764	.86	21.844	.06	.00236	.26	.01024	.46	.01811	.66	.02598	.86	.03386	
.07	1.778	.27	6.858	.47	11.938	.67	17.018	.87	22.098	.07	.00276	.27	.01063	.47	.01850	.67	.02638	.87	.03425	
.08	2.032	.28	7.112	.48	12.192	.68	17.272	.88	22.352	.08	.00315	.28	.01102	.48	.01890	.68	.02677	.88	.03465	
.09	2.286	.29	7.366	.49	12.446	.69	17.526	.89	22.606	.09	.00354	.29	.01142	.49	.01929	.69	.02717	.89	.03504	
.10	2.540	.30	7.620	.50	12.700	.70	17.780	.90	22.860	.10	.00394	.30	.01181	.50	.01969	.70	.02756	.90	.03543	
.11	2.794	.31	7.874	.51	12.954	.71	18.034	.91	23.114	.11	.00433	.31	.01220	.51	.02008	.71	.02795	.91	.03583	
.12	3.048	.32	8.128	.52	13.208	.72	18.288	.92	23.368	.12	.00472	.32	.01260	.52	.02047	.72	.02835	.92	.03622	
.13	3.302	.33	8.382	.53	13.462	.73	18.542	.93	23.622	.13	.00512	.33	.01299	.53	.02087	.73	.02874	.93	.03661	
.14	3.556	.34	8.636	.54	13.716	.74	18.796	.94	23.876	.14	.00551	.34	.01339	.54	.02126	.74	.02913	.94	.03701	
.15	3.810	.35	8.890	.55	13.970	.75	19.050	.95	24.130	.15	.00591	.35	.01378	.55	.02165	.75	.02953	.95	.03740	
.16	4.064	.36	9.144	.56	14.224	.76	19.304	.96	24.384	.16	.00630	.36	.01417	.56	.02205	.76	.02992	.96	.03780	
.17	3.318	.37	9.398	.57	14.478	.77	19.558	.97	24.638	.17	.00669	.37	.01457	.57	.02244	.77	.03032	.97	.03819	
.18	4.572	.38	9.652	.58	14.732	.78	19.812	.98	24.892	.18	.00709	.38	.01496	.58	.02283	.78	.03071	.98	.03858	
.19	4.826	.39	9.906	.59	14.986	.79	20.066	.99	25.146	.19	.00748	.39	.01535	.59	.02323	.79	.03110	.99	.03898	
.20	5.080	.40	10.160	.60	15.240	.80	20.320	1.00	25.400	.20	.00787	.40	.01575	.60	.02362	.80	.03150	1.00	.03937	

## DESCRIPTION AND OPERATION (Continued)

## TORQUE SPECIFICATIONS

## SPECIFIED TORQUE FOR STANDARD BOLTS

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			N-m	kgf-cm	ft-lbf	N-m	kgf-cm	ft-lbf
4T	6	1	5	55	48 in.-lbf	6	60	52 in.-lbf
	8	1.25	12.5	130	9	14	145	10
	10	1.25	26	260	19	29	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	74	760	55	84	850	61
	16	1.5	115	1,150	83	—	—	—
5T	6	1	6.5	65	56 in.-lbf	7.5	75	65 in.-lbf
	8	1.25	15.5	160	12	17.5	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1,050	76
	16	1.5	140	1,400	101	—	—	—
6T	6	1	8	80	69 in.-lbf	9	90	78 in.-lbf
	8	1.25	19	195	14	21	210	15
	10	1.25	39	400	29	44	440	32
	12	1.25	71	730	53	80	810	59
	14	1.5	110	1,100	80	125	1,250	90
	16	1.5	170	1,750	127	—	—	—
7T	6	1	10.5	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	105	1,050	76
	14	1.5	145	1,500	108	165	1,700	123
	16	1.5	230	2,300	166	—	—	—
8T	8	1.25	29	300	22	33	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	110	1,100	80	120	1,250	90
9T	8	1.25	34	340	25	37	380	27
	10	1.25	70	710	51	78	790	57
	12	1.25	125	1,300	94	140	1,450	105
10T	8	1.25	38	390	28	42	430	31
	10	1.25	78	800	58	88	890	64
	12	1.25	140	1,450	105	155	1,600	116
11T	8	1.25	42	430	31	47	480	35
	10	1.25	87	890	64	97	990	72
	12	1.25	155	1,600	116	175	1,800	130



# LUBRICATION AND MAINTENANCE

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## LUBRICANTS

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### DESCRIPTION AND OPERATION

#### PARTS AND LUBRICANT RECOMMENDATIONS

##### RECOMMENDATIONS

When service is required, DaimlerChrysler Corporation recommends that only Mopar® brand parts, lubricants and chemicals be used. Mopar provides the best engineered products for servicing DaimlerChrysler Corporation vehicles.

##### CLASSIFICATION OF LUBRICANTS

Only lubricants bearing designations defined by the following organization should be used to service a DaimlerChrysler Corporation vehicle.

- Society of Automotive Engineers (SAE)
- American Petroleum Institute (API) (Fig. 1)
- National Lubricating Grease Institute (NLGI)

(Fig. 2)

##### SAE VISCOSITY RATING

An SAE viscosity grade is used to specify the viscosity of engine oil. SAE 30 specifies a single viscosity engine oil. Engine oils also have multiple viscosities. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range.

- SAE 30 = single grade engine oil.
- SAE 10W-30 = multiple grade engine oil.

DaimlerChrysler Corporation only recommends multiple grade engine oils.

##### API QUALITY CLASSIFICATION

This symbol (Fig. 1) on the front of an oil container means that the oil has been certified by the American Petroleum Institute (API) to meet all the lubrication requirements specified by DaimlerChrysler Corporation.

Refer to Group 9, Engine for gasoline engine oil specification.



9400-9

*Fig. 1 API Symbol*

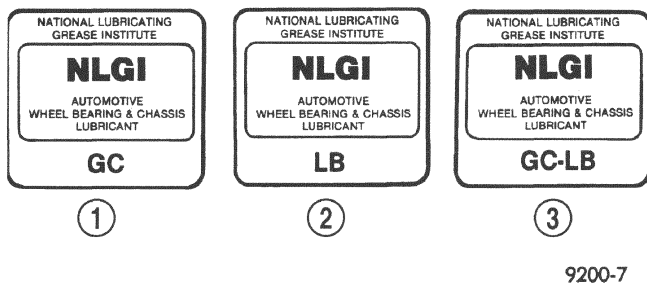
##### GEAR LUBRICANTS

SAE ratings also apply to multiple grade gear lubricants. In addition, API classification defines the lubricants usage. Such as API GL-5 and SAE 80W-90.



**DESCRIPTION AND OPERATION (Continued)****LUBRICANTS AND GREASES**

Lubricating grease is rated for quality and usage by the NLGI. All approved products have the NLGI symbol (Fig. 2) on the label. At the bottom NLGI symbol is the usage and quality identification letters. Wheel bearing lubricant is identified by the letter "G". Chassis lubricant is identified by the letter "L". The letter following the usage letter indicates the quality of the lubricant. The following symbols indicate the highest quality.

**Fig. 2 NLGI Symbol**

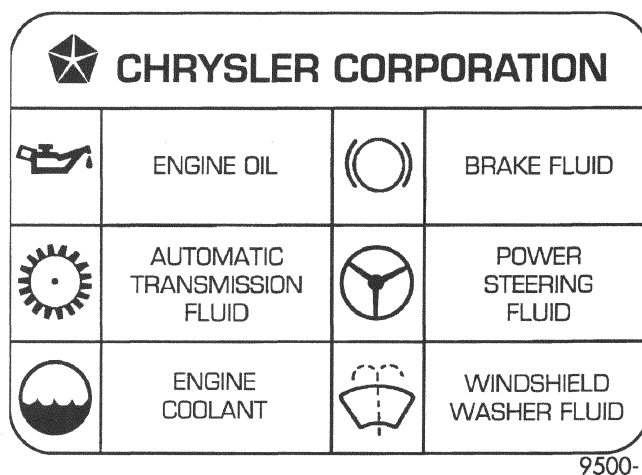
- 1 - WHEEL BEARINGS
- 2 - CHASSIS LUBRICATION
- 3 - CHASSIS AND WHEEL BEARINGS

**INTERNATIONAL SYMBOLS**

DaimlerChrysler Corporation uses international symbols to identify engine compartment lubricant and fluid check and fill locations (Fig. 3).

**FLUID CHECK/FILL POINTS AND LUBRICATION LOCATIONS**

The fluid check/fill points and lubrication locations are located in each applicable Sections.

**Fig. 3 International Symbols****LUBRICATION POINT LOCATIONS**

Lubrication point locations are located in each applicable Sections.

**SPECIFICATIONS****FLUID CAPACITIES**

Fuel Tank . . . . .	60.6 L (16 gal.)
Engine Oil With Filter - 2.5 L Engine . . . . .	4.3 L (4.5 qts.)
Engine Oil - Without Filter - 2.5 L Engine . . . . .	3.8 L (4.0 qts.)
Cooling System - 2.5 L Engine . . . . .	9.9 L (10.5 qts.)
Automatic Transaxle - Estimated Service Fill . . . . .	3.8 L (4.0 qts.)
Automatic Transaxle - Overhaul Fill Capacity with Torque Converter Empty . . . . .	8.6 L (9.1 qts.)

# MAINTENANCE SCHEDULES

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## DESCRIPTION AND OPERATION

### MAINTENANCE SCHEDULES

#### DESCRIPTION

There are two maintenance schedules that show proper service for the vehicle.

Schedule “A”. It lists all the scheduled maintenance to be performed under “normal” operating conditions.

Schedule “B”. It is a schedule for vehicles that are operated under the conditions listed at the beginning of the chart labeled Schedule “B”.

### SPECIFICATIONS

### UNSCHEDULE INSPECTION

#### *At Each Stop For Fuel*

- Check engine oil level and add as required.
- Check windshield washer solvent and add as required.

#### *Once A Month*

- Check tire pressure and look for unusual wear or damage.
- Check fluid levels of coolant reservoir, brake master cylinder, power steering and automatic transmission. Add fluid as required.
- Check all lights and all other electrical items for correct operation.

#### *At Each Oil Change*

- Inspect the exhaust system.
- Inspect brake hoses.
- Inspect the CV joints and front suspension component boots and seals.
- Rotate the tires.
- Check the engine coolant level, hoses, and clamps.

If vehicle mileage is less than 7,500 miles (12 000 km) yearly, replace the engine oil filter at each oil change.

## EMISSION CONTROL SYSTEM MAINTENANCE

The scheduled emission maintenance listed in **bold type** on the Maintenance Schedules, must be done at the mileage specified to assure the continued proper functioning of the emission control system. These, and all other maintenance services included in this manual, should be done to provide the best vehicle performance and reliability. More frequent maintenance may be needed for vehicles in severe operating conditions such as dusty areas and very short trip driving.

## FLUID FILL POINTS AND LUBRICATION LOCATIONS

The fluid fill/check locations and lubrication locations are located in each applicable group.

### SCHEDULES – A

#### **7,500 miles (12 000 km) or at 6 months**

- Change engine oil.
- Replace engine oil filter.

#### **15,000 miles (24 000 km) or at 12 months**

- Change engine oil.
- Replace engine oil filter.
- Adjust drive belt tension.

#### **22,500 Miles (36 000 km) or at 18 months**

- Change engine oil.
- Replace engine oil filter.
- Inspect the front brake pads, rear brake linings and rotors.

#### **30,000 Miles (48 000 km) or at 24 months**

- Change engine oil.
- Replace engine oil filter.
- Lubricate front and rear suspension upper ball joints.
- Adjust drive belt tension.
- Replace the **engine air cleaner element (filter)**.

**SPECIFICATIONS (Continued)****37,500 Miles (60 000 km) or at 30 months**

- Change engine oil.
- Replace engine oil filter.

**45,000 Miles (72 000 km) or at 36 months**

- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads, rear brake linings and rotors.
- Adjust drive belt tension.
- Flush and replace engine coolant.

**52,500 Miles (84 000 km) or at 42 months**

- Change engine oil.
- Replace engine oil filter.

**60,000 Miles (96 000 km) or at 48 months**

- Change engine oil.
  - Replace engine oil filter.
  - Check and replace, if necessary, the **PCV valve**.
- See note #1 after schedule "B".

- Lubricate front and rear suspension upper ball joints.

- Replace drive belts.
- Replace **engine air cleaner element (filter)**.
- Check and adjust if necessary the **ignition timing** on 2.5 liter engines.

**67,500 Miles (108 000 km) or at 54 months**

- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads, rear brake linings and rotors.

**75,000 Miles (120 000 km) or at 60 months**

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant.
- Adjust drive belt tension.

**82,500 Miles (132 000 km) or at 66 months**

- Change engine oil.
- Replace engine oil filter.

**90,000 Miles (144 000 km) or at 72 months**

- Change engine oil.
  - Replace engine oil filter.
  - Check and replace, if necessary, the **PCV valve**.
- See notes #1 and #2 after Schedule "B".

- Lubricate front and rear suspension upper ball joints.

- Inspect front brake pads, rear brake linings and rotors.

- Adjust drive belt tension.
- Replace **engine air cleaner element (filter)**.

**97,500 Miles (156 000 km) or at 78 months**

- Change engine oil.
- Replace engine oil filter.

**100,000 Miles (160 000 km) or at 80 months**

- Replace **spark plugs and ignition cables** on 2.5 liter engines.
- Change the automatic transaxle fluid and filter.

**105,000 Miles (168 000 km) or at 84 months**

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant.
- Replace the **engine timing belt** on vehicles with California emissions package.

**SCHEDULE – B**

Follow this schedule if the vehicle usually operates under one or more of the following conditions. Change the automatic transmission fluid and filter every 48,000 miles (77 000 km) if vehicle usually operates under one of the conditions marked with an \*.

- Day and night temperatures are below freezing.
- Frequent stop and go driving.\*
- Frequent long periods of engine idling.\*
- Frequent driving in dusty conditions.
- Frequent short trips of less than 5 miles.
- Frequent operation at sustained high speeds during hot weather, above 90°F (32°C).\*
- Frequent trailer towing.\*
- Taxi, police or delivery service.\*

If vehicle mileage is less than 7,500 miles (12 000 km) yearly, replace the engine oil filter at each oil change.

**3,000 Miles (5 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**6,000 Miles (10 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**9,000 Miles (14 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.



**SPECIFICATIONS (Continued)****12,000 Miles (19 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads, rear brake linings and rotors.
- Inspect and replace engine air cleaner element (filter) if necessary.

**15,000 Miles (24 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Adjust drive belt tension.
- Inspect and replace engine air cleaner element (filter) if necessary.

**18,000 Miles (29 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**21,000 Miles (34 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**24,000 Miles (38 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads, rear brake linings and rotors.
- Inspect and replace engine air cleaner element (filter) if necessary.

**27,000 Miles (43 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**30,000 Miles (48 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Replace the **PCV valve**. See note #1 after Schedule "B".
- Lubricate front and rear suspension upper ball joints.
- Adjust drive belt tension.
- Inspect and replace if required the **engine air cleaner element (filter)**. See note #1 after Schedule "B".

**33,000 Miles (53 000 km)**

- Change engine oil.
- Replace engine oil filter.

- Inspect and replace engine air cleaner element (filter) if necessary.

**36,000 Miles (58 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant.
- Inspect front brake pads, rear brake linings and rotors.
- Inspect and replace engine air cleaner element (filter) if necessary.

**39,000 Miles (62 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**42,000 Miles (67 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**45,000 Miles (72 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Adjust drive belt tension.
- Inspect and replace, if required, the **engine air cleaner element (filter)**. See note #1 after Schedule "B".
- Inspect and replace engine air cleaner element (filter) if necessary.

**48,000 Miles (77 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads and rear brake linings.
- Change the automatic transaxle fluid and filter
- Inspect and replace engine air cleaner element (filter) if necessary.

**51,000 Miles (82 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant.
- Inspect and replace engine air cleaner element (filter) if necessary.

**54,000 Miles (86 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.



**SPECIFICATIONS (Continued)****57,000 Miles (91 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**60,000 Miles (96 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Check and replace, if necessary, the **PCV valve**. See notes #1 and #2 after Schedule "B".
- Replace the **engine air cleaner element (filter)**. See note #1 after Schedule "B".
- Lubricate front and rear suspension upper ball joints.
- Replace drive belts.
- Inspect front brake pads, rear brake linings and rotors.

**63,000 Miles (101 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**66,000 Miles (106 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**69,000 Miles (110 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**72,000 Miles (115 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads, rear brake linings and rotors.
- Inspect and replace engine air cleaner element (filter) if necessary.

**75,000 Miles (120 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Adjust drive belt tension.
- Replace the **spark plugs and ignition cables** on 2.5 liter engines.
- Inspect and replace engine air cleaner element (filter) if necessary.

**78,000 Miles (125 000 km)**

- Change engine oil.
- Replace engine oil filter.

- Inspect and replace engine air cleaner element (filter) if necessary.

**81,000 Miles (130 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Flush and replace the engine coolant.
- Inspect and replace engine air cleaner element (filter) if necessary.

**84,000 Miles (134 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads, rear brake linings and rotors.
- Inspect and replace engine air cleaner element (filter) if necessary.

**87,000 Miles (139 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**90,000 Miles (144 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Check and replace, if necessary, the **PCV valve**. See notes #1 and #2 after Schedule "B".
- Lubricate front and rear suspension upper ball joints.
- Adjust drive belt tension.
- Inspect and replace if required the **engine air cleaner element (filter)**. See note #1 after Schedule "B".

**93,000 Miles (149 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**96,000 Miles (154 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect front brake pads, rear brake linings and rotors.
- Change the automatic transaxle fluid and filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**99,000 Miles (158 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**SPECIFICATIONS (Continued)****102,000 Miles (163 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace engine air cleaner element (filter) if necessary.

**NOTE: #1** This maintenance is recommended by DaimlerChrysler Motors Corporation to the owner but is not required to maintain the emissions warranty.

**105,000 Miles (168 000 km)**

- Change engine oil.
- Replace engine oil filter.
- Adjust drive belt tension.
- Inspect and replace engine air cleaner element (filter) if necessary.

**NOTE: #2** This maintenance is not required if previously replaced.



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# JUMP STARTING, TOWING, AND HOISTING

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## SERVICE PROCEDURES

### JUMP STARTING PROCEDURE

**WARNING: REVIEW ALL SAFETY PRECAUTIONS AND WARNINGS IN BATTERY/STARTING/CHARGING SECTIONS. DO NOT JUMP START A FROZEN BATTERY, PERSONAL INJURY CAN RESULT. DO NOT JUMP START WHEN MAINTENANCE FREE BATTERY INDICATOR DOT IS YELLOW OR BRIGHT COLOR. DO NOT JUMP START A VEHICLE WHEN THE BATTERY FLUID IS BELOW THE TOP OF LEAD PLATES. DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE. DO NOT USE OPEN FLAME NEAR BATTERY. REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT. WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW BATTERY VOLTAGE TO EXCEED 16 VOLTS. REFER TO INSTRUCTIONS PROVIDED WITH DEVICE BEING USED.**

**CAUTION:** When using another vehicle as a booster, do not allow vehicles to touch. Electrical systems can be damaged on either vehicle.

### TO JUMP START A DISABLED VEHICLE:

(1) Raise hood on disabled vehicle and visually inspect engine compartment for:

- Battery cable clamp condition, clean if necessary.
- Frozen battery.
- Yellow or bright color test indicator, if equipped.
- Low battery fluid level.
- Generator drive belt condition and tension.
- Fuel fumes or leakage, correct if necessary.

**CAUTION:** If the cause of starting problem on disabled vehicle is severe, damage to booster vehicle charging system can result.

(2) When using another vehicle as a booster source, park the booster vehicle within cable reach. Turn off all accessories, set the parking brake, place

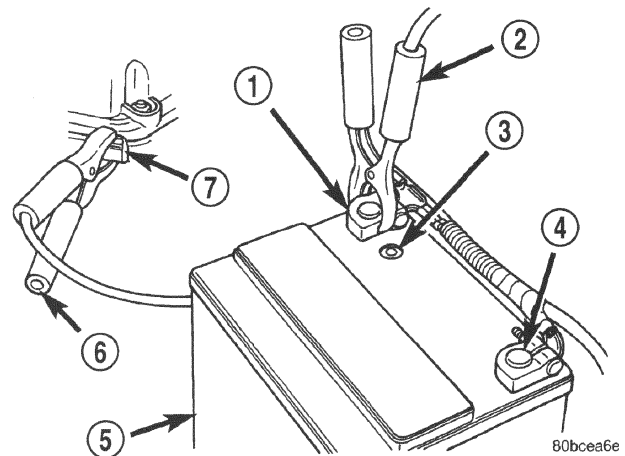
the automatic transmission in PARK or the manual transmission in NEUTRAL and turn the ignition OFF.

(3) On disabled vehicle, place gear selector in park or neutral and set park brake. Turn off all accessories.

(4) Connect jumper cables to booster battery. RED clamp to positive terminal (+). BLACK clamp to negative terminal (-). DO NOT allow clamps at opposite end of cables to touch, electrical arc will result. Review all warnings in this procedure.

(5) On disabled vehicle, connect RED jumper cable clamp to positive (+) terminal. Connect BLACK jumper cable clamp to engine ground as close to the ground cable attaching point as possible (Fig. 1).

(6) Start the engine in the vehicle which has the booster battery, let the engine idle a few minutes, then start the engine in the vehicle with the discharged battery.



**Fig. 1 Jumper Cable Clamp Connections**

- 1 - BATTERY POSITIVE CABLE
- 2 - POSITIVE JUMPER CABLE
- 3 - TEST INDICATOR
- 4 - BATTERY NEGATIVE CABLE
- 5 - BATTERY
- 6 - NEGATIVE JUMPER CABLE
- 7 - ENGINE GROUND



## SERVICE PROCEDURES (Continued)

**CAUTION:** Do not crank starter motor on disabled vehicle for more than 15 seconds, starter will over-heat and could fail.

(7) Allow battery in disabled vehicle to charge to at least 12.4 volts (75% charge) before attempting to start engine. If engine does not start within 15 seconds, stop cranking engine and allow starter to cool (15 minutes), before cranking again.

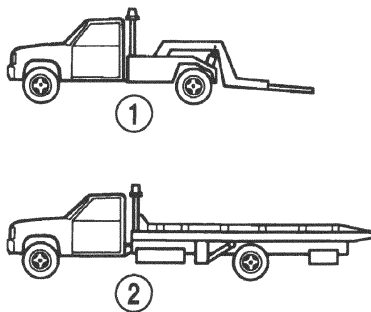
### DISCONNECT CABLE CLAMPS AS FOLLOWS:

- Disconnect BLACK cable clamp from engine ground on disabled vehicle.
- When using a Booster vehicle, disconnect BLACK cable clamp from battery negative terminal. Disconnect RED cable clamp from battery positive terminal.
- Disconnect RED cable clamp from battery positive terminal on disabled vehicle.

## TOWING RECOMMENDATIONS

### RECOMMENDED TOWING EQUIPMENT

To avoid damage to bumper fascia and air dams use of a flat bed towing device or wheel lift (Fig. 2) is recommended. When using a wheel lift towing device, be sure the unlifted end of disabled vehicle has at least 100 mm (4 in.) ground clearance. If minimum ground clearance cannot be reached, use a towing dolly. If a flat bed device is used, the approach angle should not exceed 15 degrees.



**Fig. 2 Recommended Towing Equipment**

- 1 - WHEEL LIFT  
2 - FLAT BED

## GROUND CLEARANCE

**CAUTION:** If vehicle is towed with wheels removed, install lug nuts to retain brake drums or rotors.

A towed vehicle should be raised until the lifted wheels are a minimum 100 mm (4 in.) from the ground. Be sure there is at least 100 mm (4 in.) clearance between the tail pipe and the ground. If necessary, remove the wheels from the lifted end of

the vehicle and lower the vehicle closer to the ground, to increase the ground clearance at the rear of the vehicle. Install lug nuts on wheel attaching studs to retain brake drums or rotors.

## LOCKED VEHICLE TOWING

When a locked vehicle must be towed with the front wheels on the ground, use a towing dolly or flat bed hauler.

## FLAT TOWING WITH TOW BAR

Four speed electronic transaxle vehicles can be flat towed at speeds not to exceed 72 km/h (44 mph) for not more than 160 km (100 miles). The steering column must be unlocked and gear selector in neutral.

## WARNINGS AND PRECAUTIONS

**WARNING:** DO NOT ALLOW TOWING ATTACHMENT DEVICES TO CONTACT THE FUEL TANK OR LINES, FUEL LEAK CAN RESULT. DO NOT LIFT OR TOW VEHICLE BY FRONT OR REAR BUMPER, OR BUMPER ENERGY ABSORBER UNITS. DO NOT VENTURE UNDER A LIFTED VEHICLE IF NOT SUPPORTED PROPERLY ON SAFETY STANDS. DO NOT ALLOW PASSENGERS TO RIDE IN A TOWED VEHICLE. USE A SAFETY CHAIN THAT IS INDEPENDENT FROM THE TOWING ATTACHMENT DEVICE.

**CAUTION:** Do not damage brake lines, exhaust system, shock absorbers, sway bars, or any other under vehicle components when attaching towing device to vehicle. Do not attach towing device to front or rear suspension components. Do not secure vehicle to towing device by the use of front or rear suspension or steering components. Remove or secure loose or protruding objects from a damaged vehicle before towing. Refer to state and local rules and regulations before towing a vehicle. Do not allow weight of towed vehicle to bear on lower fascia, air dams, or spoilers.

## FLAT BED TOWING TIE DOWNS

**CAUTION:** Do not tie vehicle down by attaching chains or cables to suspension components or engine mounts, damage to vehicle can result.

JX vehicles can be tied to a flat bed device using the reinforced loops located under the front and rear bumpers on the drivers side of the vehicle. There are also four reinforced elongated holes for T or R hooks located on the bottom of the front frame rail torque boxes behind the front wheels and forward of the rear wheels inboard of the rocker panel weld seam.



**SERVICE PROCEDURES (Continued)****TOWING – FRONT WHEEL LIFT**

Chrysler Corporation recommends that a vehicle be towed with the front end lifted, whenever possible. A 90 cm (36 in.) length of 4x4 wood beam can be placed between the wheel lift device and the bottom of the fascia to prevent damage to vehicle during the lifting operation. The beam can be removed after lifting the front of the vehicle.

**TOWING – REAR WHEEL LIFT**

If a vehicle cannot be towed with the front wheels lifted, the rear wheels can be lifted provided the following guide lines are observed.

**CAUTION:** Do not use steering column lock to secure steering wheel during towing operation.

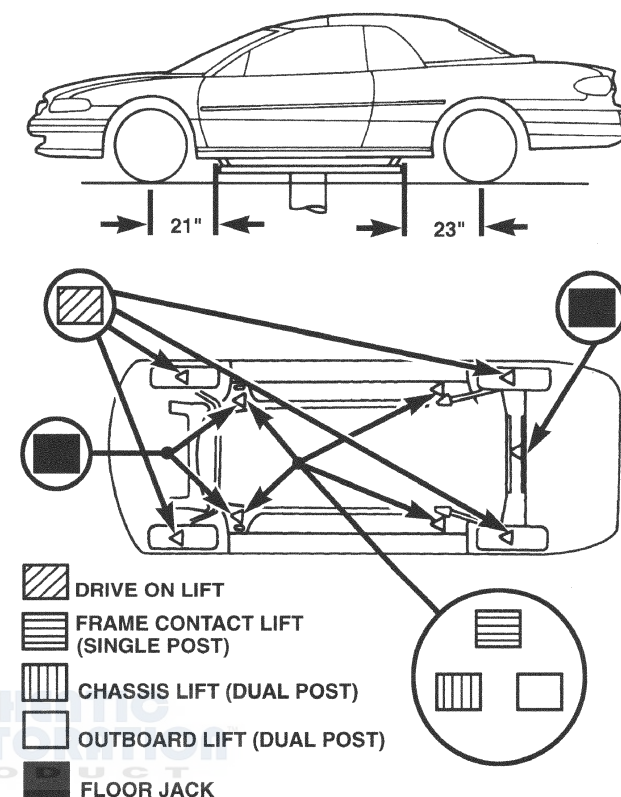
- Unlock steering column and secure steering wheel in straight ahead position with a clamp device designed for towing.
- Place front wheels on a towing dolly.

**HOISTING RECOMMENDATIONS**

Refer to Owner's Manual provided with vehicle for proper emergency jacking procedures.

**WARNING:** THE HOISTING AND JACK LIFTING POINTS PROVIDED ARE FOR A COMPLETE VEHICLE. WHEN THE ENGINE OR REAR SUSPENSION IS REMOVED FROM A VEHICLE, THE CENTER OF GRAVITY IS ALTERED MAKING SOME HOISTING CONDITIONS UNSTABLE. PROPERLY SUPPORT OR SECURE VEHICLE TO HOISTING DEVICE WHEN THESE CONDITIONS EXIST.

**CAUTION:** Do not position hoisting device on suspension components, damage to vehicle can result.



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**Fig. 3 Hoisting And Jacking Points**

# SUSPENSION

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## WHEEL ALIGNMENT

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### DESCRIPTION AND OPERATION

#### WHEEL ALIGNMENT

##### DESCRIPTION

Vehicle wheel alignment is the proper adjustment of all interrelated front and rear suspension angles. These angles are what affects the handling and steering of the vehicle when it is in motion.

The method of checking a vehicle's front and rear wheel alignment will vary depending on the type and manufacturer of the equipment being used. Instructions furnished by the manufacturer of the equipment being used should always be followed to ensure accuracy of the alignment, except when alignment specifications recommended by DaimlerChrysler differ.

Typical wheel alignment angles and measurements are camber, caster, toe, and thrust angle.

- Camber is the number of degrees the top of the tire and wheel are tilted either inward or outward (Fig. 1). Camber is a tire wearing angle. Excessive negative camber will cause tread wear at the inside of the tire, while excessive positive camber will cause outside tire wear.

- Caster is the number of degrees of forward or rearward tilt of the steering knuckle (Fig. 2). Forward tilt provides a negative caster angle, while rear-

ward tilt provides a positive caster angle. Caster is not adjustable on this vehicle.

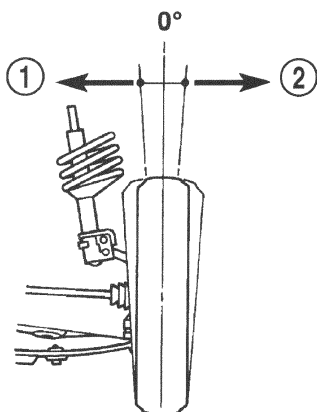
- Cross Camber is the difference between left and right camber. To achieve the cross camber reading, subtract the right side camber reading from the left. For example, if the left camber is  $+0.3^{\circ}$  and the right camber is  $0.0^{\circ}$ , the cross camber would be  $+0.3^{\circ}$ .

- Toe is measured in degrees or inches and is the difference in width between the centered leading and trailing edges of the tires on the same axle (Fig. 3). Toe-in means that the front width is more narrow than the rear. Toe-out means that the front width is wider than the rear.

- Thrust Angle is defined as the average of the toe settings on each rear wheel. If this measurement is out of specification, readjust the rear wheel toe so that each wheel has 1/2 of the total toe measurement. When readjusting, do not exceed the total toe specification.

Wheel alignment on this vehicle is to be checked and all alignment adjustments are to be made with the vehicle standing at its curb height specification. Curb height is the riding height of the vehicle measured from a certain point on the vehicle to the ground while the vehicle is setting on a flat, level surface.

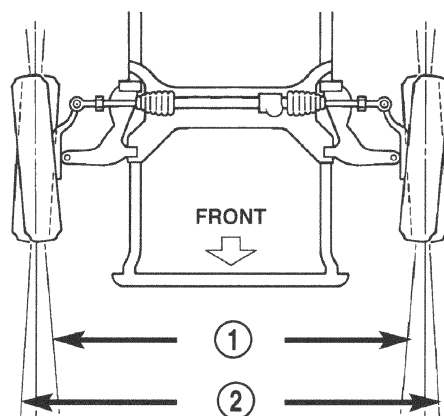
## DIAGNOSIS AND TESTING (Continued)



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**Fig. 1 Camber**

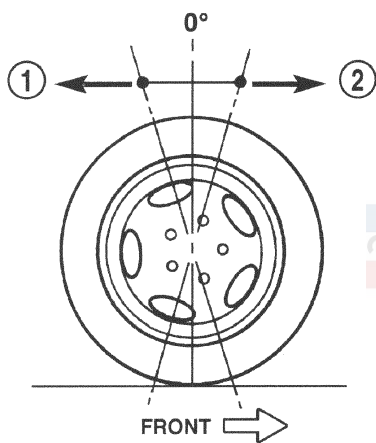
- 1 - NEGATIVE  
2 - POSITIVE



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**Fig. 3 Toe**

- 1 - TOE-IN  
2 - TOE-OUT



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**Fig. 2 Caster**

- 1 - POSITIVE  
2 - NEGATIVE



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## DIAGNOSIS AND TESTING

### SUSPENSION AND STEERING DIAGNOSIS

CONDITION	POSSIBLE CAUSES	POTENTIAL CORRECTIONS
Front End Whine On Turns	<ol style="list-style-type: none"> <li>1. Defective Wheel Bearing</li> <li>2. Incorrect Wheel Alignment</li> <li>3. Worn Tires</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace Wheel Bearing</li> <li>2. Check And Reset Wheel Alignment</li> <li>3. Replace Tires</li> </ol>
Front End Growl Or Grinding On Turns	<ol style="list-style-type: none"> <li>1. Defective Wheel Bearing</li> <li>2. Engine Mount Grounding Against Frame Or Body Of Vehicle.</li> <li>3. Worn Or Broken C/V Joint</li> <li>4. Loose Wheel Lug Nuts</li> <li>5. Incorrect Wheel Alignment</li> <li>6. Worn Tires</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace Wheel Bearing</li> <li>2. Check For Motor Mount Hitting Frame Rail And Reposition Engine As Required</li> <li>3. Replace C/V Joint</li> <li>4. Verify Wheel Lug Nut Torque</li> <li>5. Check And Reset Wheel Alignment</li> <li>6. Replace Tires</li> </ol>
Front End Clunk Or Snap On Turns	<ol style="list-style-type: none"> <li>1. Loose Wheel Lug Nuts</li> <li>2. Worn Or Broken C/V Joint</li> <li>3. Worn Or Loose Tie Rod Or Ball Joint</li> <li>4. Worn Control Arm Bushing</li> <li>5. Loose Sway Bar Or Upper Strut Attachment</li> </ol>	<ol style="list-style-type: none"> <li>1. Verify Wheel Lug Nut Torque</li> <li>2. Replace C/V Joint</li> <li>3. Tighten Or Replace Tie Rod End Or Ball Joint</li> <li>4. Replace Control Arm Bushing</li> <li>5. Tighten Sway Bar Or Upper Strut Attachment To Specified Torque</li> </ol>
Front End Whine With Vehicle Going Straight At A Constant Speed	<ol style="list-style-type: none"> <li>1. Defective Wheel Bearing</li> <li>2. Incorrect Wheel Alignment</li> <li>3. Worn Tires</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace Wheel Bearing</li> <li>2. Check And Reset Wheel Alignment</li> <li>3. Replace Tires</li> </ol>
Front End Growl Or Grinding With Vehicle Going Straight At A Constant Speed	<ol style="list-style-type: none"> <li>1. Engine Mount Grounding</li> <li>2. Worn Or Broken C/V Joint</li> </ol>	<ol style="list-style-type: none"> <li>1. Reposition Engine As Required</li> <li>2. Replace C/V Joint</li> </ol>
Front End Whine When Accelerating Or Decelerating	<ol style="list-style-type: none"> <li>1. Worn Or Defective Transaxle Gears Or Bearings</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace Transaxle Gears Or Bearings</li> </ol>
Front End Clunk When Accelerating Or Decelerating	<ol style="list-style-type: none"> <li>1. Worn Or Broken Engine Mount</li> <li>2. Worn Or Defective Transaxle Gears Or Bearings</li> <li>3. Loose Wheel Lug Nuts</li> <li>4. Worn Or Broken C/V Joint</li> <li>5. Worn Or Loose Ball Joint</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace Engine Mount</li> <li>2. Replace Transaxle Gears Or Bearings</li> <li>3. Verify Wheel Lug Nut Torque</li> <li>4. Replace C/V Joint</li> <li>5. Tighten Or Replace Ball Joint</li> </ol>



**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSES	POTENTIAL CORRECTIONS
	6. Worn Or Loose Control Arm Bushing 7. Loose Crossmember Bolts	6. Tighten To Specified Torque Or Replace Control Arm Bushing 7. Tighten Crossmember Bolts To Specified Torque
Road Wander	1. Incorrect Tire Pressure 2. Incorrect Front Or Rear Wheel Toe 3. Worn Wheel Bearings 4. Worn Control Arm Bushings 5. Excessive Friction In Steering Gear 6. Excessive Friction In Steering Shaft Coupling 7. Excessive Friction In Strut Upper Bearing	1. Inflate Tires To Recommended Pressure 2. Check And Reset Front Wheel Toe 3. Replace Wheel Bearing 4. Replace Control Arm Bushing 5. Replace Steering Gear 6. Replace Steering Coupler 7. Replace Strut Bearing
Lateral Pull	1. Unequal Tire Pressure 2. Radial Tire Lead 3. Incorrect Front Wheel Camber 4. Power Steering Gear Imbalance 5. Wheel Braking	1. Inflate All Tires To Recommended Pressure 2. Perform Lead Correction Procedure 3. Check And Reset Front Wheel Camber 4. Replace Power Steering Gear 5. Correct Braking Condition Causing Lateral Pull
Excessive Steering Free Play	1. Incorrect Steering Gear Adjustment 2. Worn Or Loose Tie Rod Ends 3. Loose Steering Gear Mounting Bolts 4. Loose Or Worn Steering Shaft Coupler	1. Adjust Or Replace Steering Gear 2. Replace Or Tighten Tie Rod Ends 3. Tighten Steering Gear Bolts To The Specified Torque 5. Replace Steering Shaft Coupler
Excessive Steering Effort	1. Low Tire Pressure 2. Lack Of Lubricant In Steering Gear 3. Low Power Steering Fluid Level 4. Loose Power Steering Pump Belt 5. Lack Of Lubricant In Steering Ball Joints 6. Steering Gear Malfunction 7. Lack Of Lubricant In Steering Coupler	1. Inflate All Tires To Recommended Pressure 2. Replace Steering Gear 3. Fill Power Steering Fluid Reservoir To Correct Level 4. Check and replace automatic belt tensioner as necessary. If drive belt is worn or glazed, replace belt. 5. Lubricate Or Replace Steering Ball Joints 6. Replace Steering Gear 7. Replace Steering Coupler

## SERVICE PROCEDURES

### PRE-WHEEL ALIGNMENT INSPECTION

Before any attempt is made to change or correct the wheel alignment, the following inspection and necessary corrections must be made to the vehicle to ensure proper alignment.

(1) Be sure the fuel tank is full of fuel. If the fuel tank is not full, the reduction in weight will affect the curb height of the vehicle and the alignment specifications.

(2) The passenger and luggage compartments of the vehicle should be free of any load that is not factory equipment.

(3) Check the tires on the vehicle. The tires are to be inflated to the recommended air pressure. All tires must be the same size and in good condition with approximately the same tread wear.

(4) Check the front tire and wheel assemblies for excessive radial runout.

(5) Inspect all suspension component fasteners for looseness and torque.

(6) Inspect the lower front ball joints and all steering linkage for looseness and any sign of wear or damage.

(7) Inspect the rubber bushings on all the suspension components for signs of wear or deterioration. If any bushings show signs of wear or deterioration, they should be replaced prior to aligning the vehicle.

(8) Check vehicle curb height to verify it is within specifications. Refer to CURB HEIGHT MEASURE-

MENT in this section. If curb height is out of specifications, check for broken or sagged springs.

### CURB HEIGHT MEASUREMENT

The wheel alignment is to be checked and all alignment adjustments made with the vehicle at its required curb height specification.

Vehicle height is to be checked with the vehicle on a flat, level surface, preferably a vehicle alignment rack. The tires are to be inflated to the recommended pressure. All tires are to be the same size as standard equipment. Vehicle height is checked with the fuel tank full of fuel, and no passenger or luggage compartment load.

Vehicle height is not adjustable. If the measurement is not within specifications, inspect the vehicle for bent or weak suspension components. Compare the parts tag on the suspect coil spring(s) to the parts book and the vehicle sales code, checking for a match. Once removed from the vehicle, compare the coil spring height to a correct new or known good coil spring. The heights should vary if the suspect spring is weak.

(1) Measure from the inboard edge of the wheel opening fender lip directly above the wheel center (spindle), to the floor or alignment rack surface.

(2) When measuring, maximum left-to-right differential is not to exceed 20 mm (0.79 in.).

(3) Compare the measurements to specifications listed in the following CURB HEIGHT SPECIFICATIONS chart.

#### CURB HEIGHT SPECIFICATIONS

VEHICLE	FRONT	REAR
ALL	711 mm $\pm$ 19 mm 28.0 in. $\pm$ 0.75 in.	711 mm $\pm$ 19 mm 28.0 in. $\pm$ 0.75 in.

### WHEEL ALIGNMENT

(1) Position the vehicle on an alignment rack.

(2) Perform the PRE-WHEEL ALIGNMENT INSPECTION. It can be found elsewhere in this section.

(3) Install all required alignment equipment on the vehicle per the alignment equipment manufacturer's instructions. On this vehicle, a four-wheel alignment is recommended.

**NOTE:** Prior to reading the vehicle's alignment readouts, the front and rear of vehicle should be jounced. Induce jounce (rear first, then front) by grasping the center of the bumper and jouncing each end of vehicle an equal number of times. The bumper should always be released when vehicle is at the bottom of the jounce cycle.

(4) Read the vehicle's current front and rear alignment settings. Compare the vehicle's current alignment settings to the vehicle specifications for camber, caster and toe-in. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this section of this service manual group.

**NOTE:** Set the rear wheel alignment first before proceeding to the front to set the front wheel alignment.

(5) If rear camber or toe is not within specifications, proceed to REAR CAMBER AND TOE below. If rear camber and toe are within specifications, but front camber and caster are not, proceed to FRONT CAMBER AND CASTER which can be found following REAR CAMBER AND TOE. If rear camber and

**SERVICE PROCEDURES (Continued)**

toe, and front camber and caster are within specifications, proceed to FRONT TOE.

Rear Caster on this vehicle is not adjustable and is not shown as an alignment specification.

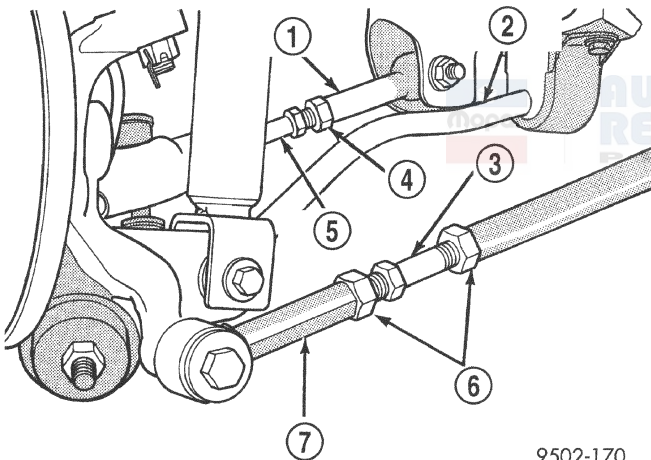
**CAUTION:** Do not attempt to adjust the vehicle's wheel alignment by heating, bending or modifying any component of the suspension.

**REAR CAMBER AND TOE**

Rear Camber on this vehicle is adjustable. The rear camber on this vehicle is adjusted using the adjusting screw located in the forward and rear lateral links of the vehicles rear suspension (Fig. 4).

**CAUTION:** When checking the rear alignment on this vehicle, the alignment rack must be equipped with rear skid plates.

(1) For either rear wheel needing alignment, loosen the adjusting screw jam nuts (Fig. 4) on both the front and the rear lateral links.



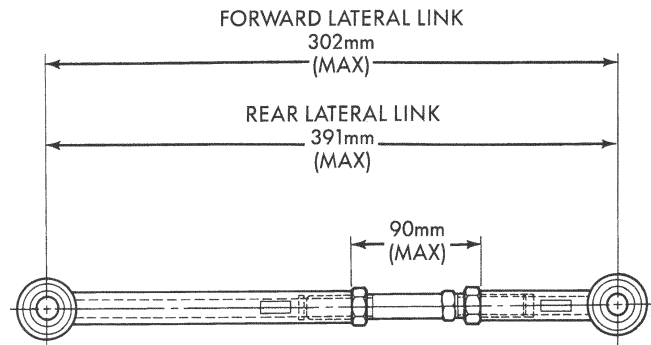
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**Fig. 4 Lateral Link Adjusting Screw Jam Nuts**

- 1 - FORWARD LATERAL ARM
- 2 - STABILIZER BAR
- 3 - ADJUSTING SCREW
- 4 - JAM NUT
- 5 - ADJUSTING SCREW
- 6 - JAM NUTS
- 7 - REAR LATERAL LINK

**CAUTION:** Do not attempt to move the adjusting screws without properly loosening the jam nuts. Note that each adjusting screw has one right-handed nut and one left-handed nut.

**CAUTION:** When setting rear camber and toe on the vehicle, the maximum lengths of the adjustable lateral link at the locations shown (Fig. 5) must not be exceeded. If these maximum lengths are exceeded, inadequate retention of adjustment link to the inner and outer link may result.



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**Fig. 5 Rear Lateral Link Maximum Length Dimensions**

(2) Rough-in the rear camber setting as close as possible to the preferred specification by mainly adjusting the rear lateral link adjusting screw (Fig. 4). Some adjustment of the forward lateral link adjusting screw will also be required to get the rear camber setting to the preferred specification. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this group for the specification.

(3) Adjust the forward lateral link adjusting screw (Fig. 4) to set rear toe to the preferred specification. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this group for the specification.

**NOTE:** Adjusting toe will cause a slight change in the camber setting. If during the setting of toe, camber is no longer at the preferred specification, continue to adjust camber and toe until both are at their preferred specifications.

(4) While holding adjustment screws from turning, use a crow foot and torque wrench, and tighten all lateral link adjusting screw jam nuts to a torque of 92 N·m (68 ft. lbs.). This will securely hold the adjusting screws from turning.

(5) Proceed to FRONT CASTER AND CAMBER, or FRONT TOE if front caster and camber are within specifications.



## SERVICE PROCEDURES (Continued)

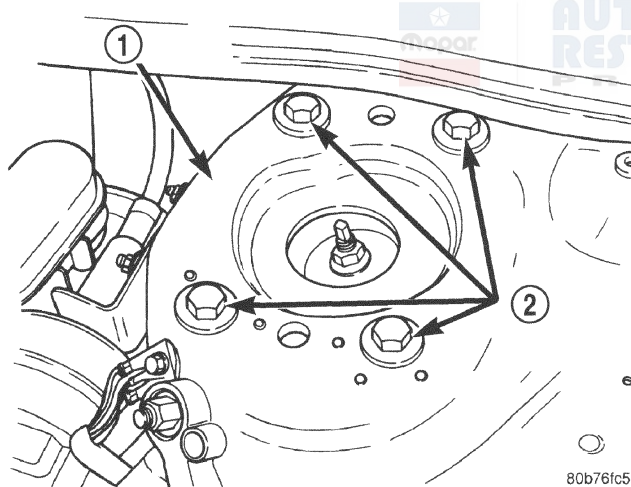
### FRONT CAMBER AND CASTER

Camber and caster settings on this vehicle are determined at the time the vehicle is designed, by the location of the vehicle's suspension components. This is referred to as NET BUILD. The result is no required adjustment of camber and caster after the vehicle is built or when servicing the suspension components. Thus, when performing a wheel alignment, caster and camber are not normally considered adjustable angles. Camber and caster should be checked to ensure they meet vehicle specifications. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this group of the service manual for the specifications.

If front camber is found not to meet alignment specifications, it can be adjusted using a procedure listed here. Before performing the camber adjustment procedure, inspect the suspension components for any signs of damage or bending.

### CAMBER ADJUSTMENT PROCEDURE

(1) Open the hood and mark the position of all four shock assembly mounting bolts on the shock tower (Fig. 6) on the side of the vehicle requiring front camber adjustment.



**Fig. 6 Shock Assembly Mounting Bolts**

- 1 - SHOCK TOWER
- 2 - MOUNTING BOLTS

(2) Raise the vehicle by the frame until the tires and front suspension are not supporting the weight of the vehicle.

(3) Loosen the shock assembly mounting bolts on the side marked in step 1. Loosen the bolts enough to allow adequate space for removal of the plastic locating pins that align the upper mounting bracket with the shock tower.

(4) Remove and discard both plastic locating pins from the shock assembly upper mounting bracket using a punch or pliers.

**NOTE: Do not leave the plastic locating pins in the cavity of the shock tower or mount. Objectionable noise may result.**

(5) Position the shock assembly inboard or outboard as required to adjust the camber. Make sure the fore and aft position is in the same as indicated by the marks made prior to adjustment, and also the forward and rearward bolts are moved equal amounts inward or outward.

**NOTE: Do not attempt to enlarge any existing holes to increase adjustment range.**

(6) Torque the upper shock assembly mounting bolts to 90 N·m (68 ft. lbs.)

(7) Lower the vehicle. Jounce the front and rear of vehicle an equal amount of times.

(8) Check and adjust the front camber as necessary. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this group of the service manual for preferred specification.

(9) If toe readings obtained are not within the required specification range, adjust toe to meet the preferred specification setting. Toe is adjustable using the following procedure.

### FRONT TOE

(1) Center the steering wheel and lock in place using a steering wheel clamp.

**CAUTION: Do not twist front inner tie rod to steering gear rubber boots during front wheel Toe adjustment.**

(2) Loosen front inner to outer tie rod end jam nuts (Fig. 7). Grasp inner tie rods at serrations and rotate inner tie rods of steering gear to set front toe to the preferred toe specification. Refer to WHEEL ALIGNMENT SPECIFICATIONS in this group of the service manual for preferred specification.

(3) Tighten tie rod jam nuts (Fig. 7) to 61 N·m (45 ft. lbs.) torque.

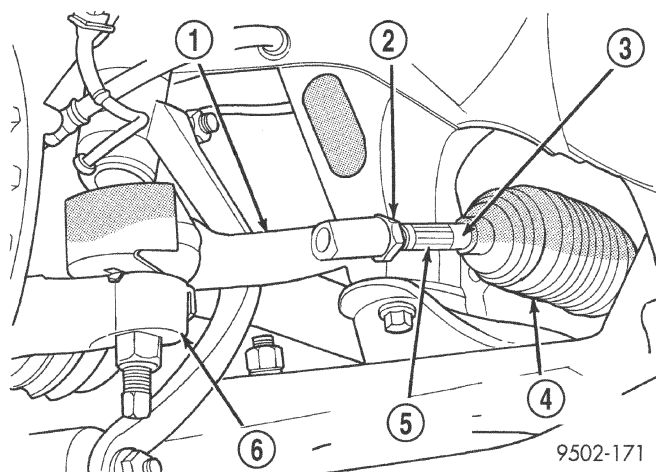
(4) Adjust steering gear to tie rod boots at the inner tie rod.

(5) Remove steering wheel clamp.

(6) Remove the alignment equipment.

(7) Road test the vehicle to verify the steering wheel is straight and the vehicle does not wander or pull.



**SPECIFICATIONS (Continued)****Fig. 7 Front Wheel Toe Adjustment**

- 1 - OUTER TIE ROD
- 2 - JAM NUT
- 3 - INNER TIE ROD
- 4 - STEERING GEAR BOOTS
- 5 - ADJUSTMENT SERRATIONS
- 6 - STEERING KNUCKLE

**SPECIFICATIONS****WHEEL ALIGNMENT SPECIFICATIONS**

**NOTE:** All specifications are given in degrees.

**AUTHENTIC  
RESTORATION**

**NOTE:** All wheel alignments are to be set with the vehicle at its proper curb height. Refer to CURB HEIGHT MEASUREMENT in SERVICE PROCEDURES.

FRONT WHEEL ALIGNMENT	PREFERRED SETTING	ACCEPTABLE RANGE
CAMBER . . . . .	+0.1°	-0.5° to +0.7°
Cross Camber (Maximum side-to-side difference)	0.0°	0.7°
CASTER. . . . .	+3.1°	+2.1° to +4.1°
Cross Caster (Maximum side-to-side difference)	0.0°	1.0°
TOE* - RIGHT OR LEFT	+0.05°	-0.05° to +0.15°
TOTAL TOE* **	+0.1°	-0.1° to +0.3°
REAR WHEEL ALIGNMENT	PREFERRED SETTING	ACCEPTABLE RANGE
CAMBER . . . . .	-0.1°	-0.5° to +0.3°
TOE* - RIGHT OR LEFT	+0.05°	-0.05° to +0.15°
TOTAL TOE* **	+0.1°	-0.1° to +0.3°
THRUST ANGLE. . . . .	0.0°	0.0 ± 0.15°

\*Positive (+) toe is toe-in, negative (-) toe is toe-out.

\*\*Total toe is the arithmetic sum of the left and right wheel toe settings. Total Toe must be equally split between each front wheel to ensure the steering wheel is centered after setting Toe. Left and right toe must be equal to within 0.02 degrees.

## FRONT SUSPENSION

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## DESCRIPTION AND OPERATION

### FRONT SUSPENSION SYSTEM

#### DESCRIPTION

This vehicle's front suspension is a short long arm design used in conjunction with a gas pressurized shock absorber and coil spring assembly (Fig. 1).

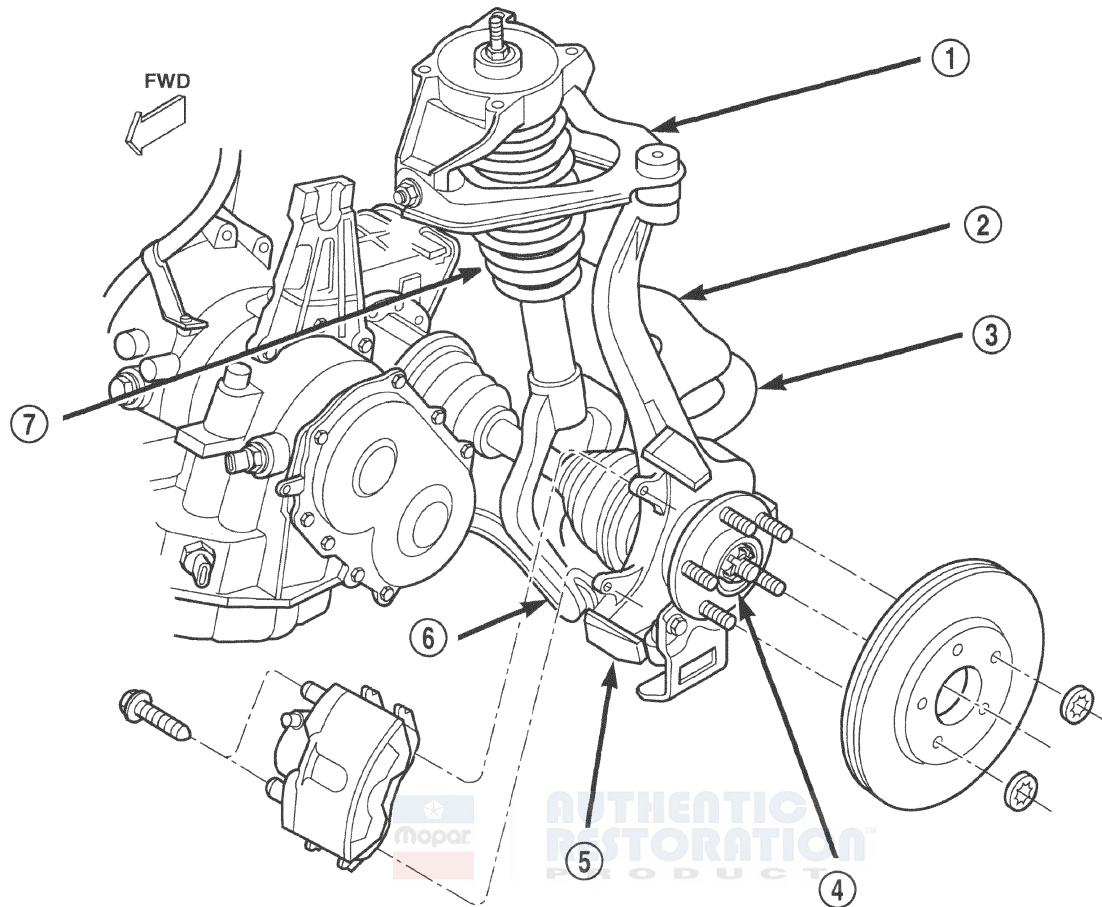
The upper control arm of the vehicle is mounted using rubber isolation bushings to an aluminum casting which is attached to the shock tower using 4 mounting bolts. This aluminum casting is also used as the upper mount for the front shock/coil spring assembly. The shock absorber assembly is also isolated from the aluminum bracket using a 2 piece rubber bushing design. The lower control arm is mounted to the vehicle's front suspension crossmember using 2 through bolts per control arm. The lower control arm is also isolated from the vehicle using 2 rubber bushings of unique design for the front and rear mounting location. The bottom of the shock absorber is mounted to the lower control arm by a clevis bracket which is part of the shock absorber

assembly. The clevis bracket is mounted to and isolated from the lower control arm using a rubber isolation bushing and a through-bolt. The front steering knuckle is mounted to the vehicle by a ball joint located in the upper and lower control arms.

A sealed for life front hub and bearing assembly is attached to the front steering knuckle. The outer C/V joint assembly is splined to the front hub and bearing assembly and is retained by a nut, nut retainer and cotter pin.

#### OPERATION

The front suspension allows each front wheel on vehicle to adapt to different road surfaces and conditions without affecting the control of the vehicle. Each side of the front suspension is allowed to move independently from the other. Both sides of the front suspension are allowed to pivot so the vehicle can be steered in the direction preferred. Steering of the vehicle is provided by a rack and pinion steering gear which is connected directly to each steering knuckle by an outer tie rod.

**DESCRIPTION AND OPERATION (Continued)**

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**Fig. 1 Front Suspension Components**

- |                                  |                       |
|----------------------------------|-----------------------|
| 1 – UPPER CONTROL ARM            | 5 – STEERING KNUCKLE  |
| 2 – FRONT SUSPENSION CROSSMEMBER | 6 – LOWER CONTROL ARM |
| 3 – STABILIZER BAR               | 7 – STRUT ASSEMBLY    |
| 4 – HUB AND BEARING              |                       |

**SHOCK ASSEMBLY (FRONT)****DESCRIPTION**

The front shock assembly and suspension of the vehicle is supported by coil springs positioned around shock absorbers. The springs are contained between an upper seat located in the upper mounting bracket and a lower spring seat on the shock absorber.

The top of each shock absorber is bolted to a cast shock absorber/upper control arm bracket which is bolted to the shock tower of the vehicle using 4 mounting bolts.

The bottom of the shock absorber attaches to a clevis bracket using a pinch bolt. The clevis bracket attaches to the lower control arm of the vehicle using a through-bolt and prevailing torque nut.

A coil spring is housed within each shock assembly. Coil springs are rated separately for each corner or side of the vehicle depending on optional equipment

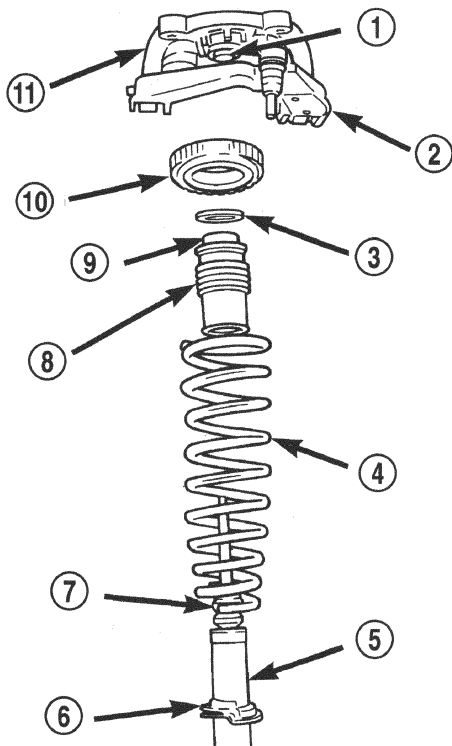
and type of vehicle service. If the coil springs require replacement, be sure that the springs needing replacement, are replaced with springs meeting the correct load rating and spring rate for the vehicle and its specific options.

The components of the shock assembly listed below are serviceable if found to be defective (Fig. 2) :

- Upper mounting bracket
- Upper spring isolator
- Dust shield
- Cup
- Jounce bumper
- Coil spring
- Shock absorber
- Lower spring isolator

The shock absorber/upper control arm mounting bracket also provides a pivotal mounting point for the upper control arm.



**DESCRIPTION AND OPERATION (Continued)**

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**Fig. 2 Shock Assembly Components**

- 1 - SHOCK ABSORBER ROD BUSHING
- 2 - UPPER CONTROL ARM
- 3 - RETAINER WASHER
- 4 - COIL SPRING
- 5 - SHOCK ABSORBER
- 6 - LOWER SPRING ISOLATOR
- 7 - JOUNCE BUMPER
- 8 - DUST SHIELD
- 9 - CUP
- 10 - UPPER SPRING ISOLATOR
- 11 - UPPER MOUNTING BRACKET

**OPERATION**

The shock absorber assembly cushions the ride of the vehicle, controlling vibration, and jounce and rebound of the suspension.

The coil spring controls ride quality and maintains proper ride height.

The spring isolators isolate the coil spring at the top and bottom from coming into metal-to-metal contact with the upper mounting bracket and shock absorber.

The jounce bumper limits suspension travel and metal-to-metal contact under full jounce condition.

The shock absorber dampens jounce and rebound motions of the coil spring and suspension.

**STEERING KNUCKLE****DESCRIPTION**

The steering knuckle is a single casting with legs machined for attachment to the vehicle's upper and lower control arm ball joints. The steering knuckle also has machined abutments on the casting to support and align the front brake caliper assembly. The knuckle also holds the front drive shaft outer C/V joint hub and bearing assembly. The hub is positioned through the bearing and knuckle, with the constant velocity stub shaft splined through the hub. The outer C/V joint is retained to the hub and bearing assembly using a nut, nut lock and cotter pin.

**OPERATION**

The steering knuckle pivots between the upper and lower ball joints. The steering gear outer tie rod end connects to the trailing end of each knuckle, allowing the vehicle to be steered.

The center of the knuckle supports the hub and bearing and axle shaft.

**HUB AND BEARING (FRONT)****DESCRIPTION**

The bearing used on the front hub of this vehicle is the combined hub and bearing unit type assembly. This unit combines the front wheel mounting hub (flange) and the front wheel bearing into a one piece unit. The hub and bearing assembly is mounted to the steering knuckle and is retained by three mounting bolts accessible from the back of the steering knuckle. The hub and bearing unit is not serviceable and must be replaced as an assembly if the bearing or the hub is determined to be defective. The wheel mounting studs used to mount the tire and wheel to the vehicle are the only replaceable components of the hub and bearing assembly.

**OPERATION**

The hub and bearing has internal bearings that allow the hub to rotate with the driveshaft and tire and wheel.

**UPPER CONTROL ARM (FRONT)****DESCRIPTION**

The upper control arm is a high strength steel stamping. The upper control arm uses the 2 rubber bushings of the upper control arm/shock absorber mounting bracket to isolate it from the mounting bracket and the body of the vehicle. The upper control arm is bolted to the top of the steering knuckle through the upper ball joint.



**DESCRIPTION AND OPERATION (Continued)****OPERATION**

The upper control arm supports the upper end of the steering knuckle and allows for the up and down movement of the suspension during the jounce and rebound travel.

**BALL JOINT (FRONT UPPER)****DESCRIPTION**

The ball joint is pressed into the upper control arm and has a tapered stud for attachment to the steering knuckle. The ball joint stud is attached and locked into the steering knuckle using a castle nut and cotter pin. The ball joint is not serviceable as a separate component of the upper control arm. If the ball joint is defective it will require replacement of the entire upper control arm.

**OPERATION**

The ball joint is a pivotal joint that allows the knuckle to move up and down and turn with ease.

**LOWER CONTROL ARM****DESCRIPTION**

The lower control arm is a ductile iron casting using 2 rubber bushings to isolate it from the front suspension crossmember and body of the vehicle. The isolator bushings consist of 2 metal encased rubber isolated pivot bushings. The front of the lower control arm is bolted to the front crossmember using a bolt through the center of the rubber pivot bushing. The rear of the lower control arm is mounted to the front suspension crossmember using a through-bolt. The lower control arms are inter-connected through a linked rubber isolated sway bar.

**OPERATION**

The lower control arm supports the lower end of the steering knuckle and allows for the up and down movement of the suspension during the jounce and rebound travel. It also provides a lower mounting point for the shock assembly.

**BALL JOINT (LOWER)****DESCRIPTION**

The ball joint used in the lower control arm of this vehicle is a sealed for life ball joint. The ball joint can not be replaced as a separate component of the lower control arm assembly. If the ball joint is determined to be defective it will require replacement of the complete lower control arm assembly.

The lower ball joint connection to the steering knuckle is achieved by an interference fit created by the tapered stud of the ball joint and a tapered hole

in the steering knuckle. The ball joint stud is retained in the steering knuckle using a castle nut and a cotter pin. The cotter pin is used for positive retention of the castle nut.

The lower ball joint is lubricated for life at the time it is assembled in the lower control arm.

**NOTE:** The ball joint does not require any type of additional lubrication for the life of the vehicle. No attempt should be made to ever add any lubrication to the lower ball joint.

**OPERATION**

The ball joint is a pivotal joint that allows the knuckle to move up and down, and turn with ease.

**STABILIZER BAR (FRONT)****DESCRIPTION**

The stabilizer bar interconnects both front lower control arms of the vehicle and is attached to the front suspension cradle and the underbody of the vehicle.

Attachment of the stabilizer bar to the front suspension cradle is through 2 rubber-isolator bushings and bushing retainers. The stabilizer bar to lower control arm attachment is done utilizing a ball joint type, stabilizer bar attaching link. All parts of the stabilizer bar are replaceable as individual components, and the bushings attaching the stabilizer bar to crossmember are split for easy removal and installation.

**OPERATION**

Jounce and rebound movements affecting one wheel are partially transmitted to the opposite wheel of the vehicle to stabilize body roll through the stabilizer bar.

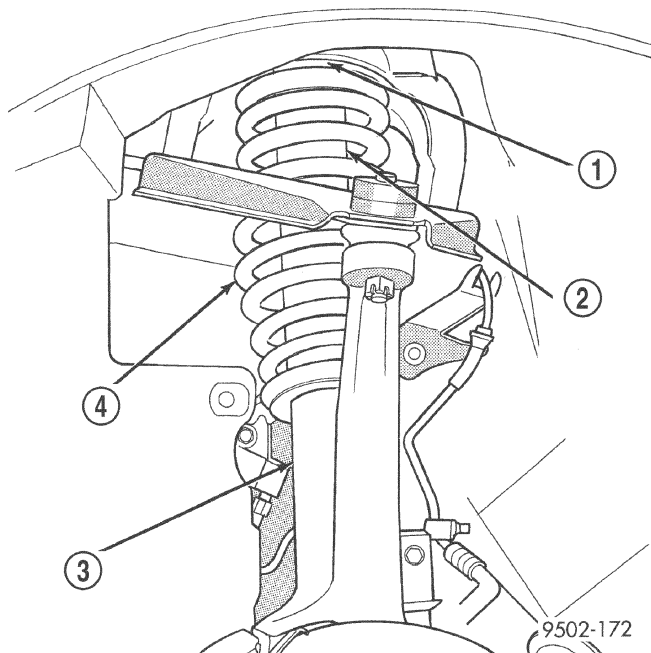
**DIAGNOSIS AND TESTING****SHOCK ASSEMBLY (FRONT)**

(1) Inspect for damaged or broken coil springs (Fig. 3).

(2) Inspect for torn or damaged shock absorber dust boots (Fig. 3).

(3) Lift the dust boot and inspect the shock absorber for evidence of fluid running from the upper end of fluid reservoir. (Actual leakage will be a stream of fluid running down the side and dripping off the lower end of the shock absorber). A slight amount of seepage between the shock absorber rod and the seal is not unusual and does not affect performance of the shock absorber. Also inspect jounce bumpers for signs of damage or deterioration (Fig. 3).

## DIAGNOSIS AND TESTING (Continued)



**Fig. 3 On Vehicle Inspection**

- 1 - UPPER SPRING SEAT
- 2 - DUST BOOT
- 3 - SHOCK ABSORBER
- 4 - COIL SPRING

### STEERING KNUCKLE

The front suspension steering knuckle is not a repairable component of the front suspension. It must be replaced if found to be damaged in any way. If it is determined that the steering knuckle is bent when servicing the vehicle, no attempt is to be made to straighten the steering knuckle.

### HUB AND BEARING (FRONT)

The hub and bearing is designed for the life of the vehicle and requires no type of periodic maintenance. The following procedure may be used for diagnosing the condition of the wheel bearing and hub.

With the wheel, disc brake caliper, and brake rotor removed, rotate the wheel hub. Any roughness or resistance to rotation may indicate dirt intrusion or a failed hub bearing. If the bearing exhibits any of these conditions during diagnosis, the hub bearing will require replacement. The bearing is not serviceable.

Damaged bearing seals and the resulting excessive grease loss may also require bearing replacement. Moderate grease weepage from the bearing is considered normal and should not require replacement of the wheel bearing.

To diagnose a bent hub, refer to BRAKE ROTOR in the DIAGNOSIS AND TESTING section in the

BRAKES service manual group for the procedure on measuring hub runout.

### UPPER CONTROL ARM (FRONT)

If damaged, the upper control arm is serviced only as a complete component. Inspect the upper control arm for any signs of damage. If control arm shows any sign of damage the upper control arm must be replaced. Do not attempt to repair or straighten a broken or bent upper control arm.

The only serviceable component of the upper control arm is the ball joint grease seal. No other repair or replacement procedure should be attempted on any component of the upper control arm. Service procedures to replace the serviceable components are detailed in the specific component sections of this group.

### BALL JOINT (FRONT UPPER)

With the weight of the vehicle resting on the road wheels, grasp the grease fitting and with no mechanical assistance or added force, attempt to move the grease fitting.

If the ball joint is worn the grease fitting will move easily. If movement is noted, replacement of the upper control arm is required.

### LOWER CONTROL ARM

If damaged, the lower control arm casting is serviced only as a complete component. Inspect lower control arm for signs of damage from contact with the ground or road debris. If lower control arm shows any sign of damage, inspect lower control arm for distortion. **Do not attempt to repair or straighten a broken or bent lower control arm.**

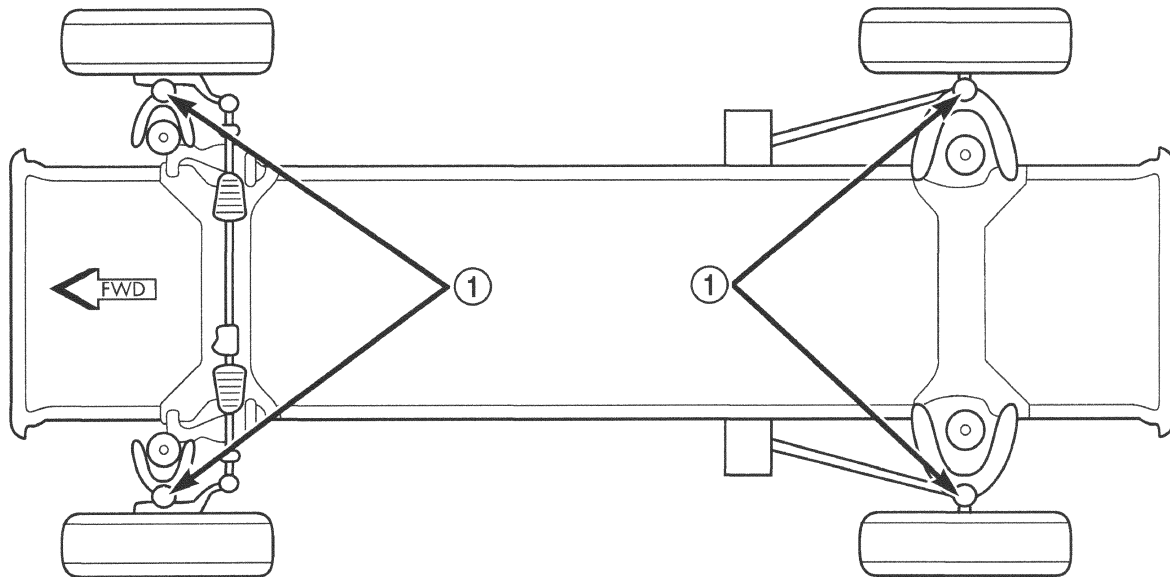
The replaceable components of the lower control arm are: the ball joint grease seal and the control arm bushings. Inspect both control arm bushings for severe deterioration, and replace if required.

Inspect the lower ball joint for wear. Use the wear inspection procedure in the diagnosis and testing section in this group of service manual to determine if the wear is excessive and ball joint (lower control arm) replacement is required.

Service procedures to replace these components are detailed in the specific component removal and installation sections in this group of the service manual.

### BALL JOINT (LOWER)

(1) Raise the vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

**DIAGNOSIS AND TESTING (Continued)**

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**Fig. 4 Lubrication Points**

1 – UPPER BALL JOINTS

(2) Install a dial indicator on the vehicle so it is contacting the top surface of the steering knuckle near the lower ball joint stud castle nut.

(3) Grab wheel and tire assembly and push it up and down firmly.

(4) Record the amount of up and down movement of the steering knuckle recorded on the dial indicator.

(5) Replace lower control arm if the movement in the lower control arm exceeds 1.5 mm (.059 in.).

**STABILIZER BAR (FRONT)**

Inspect for broken or distorted stabilizer bar bushings, bushing retainers, and worn or damaged stabilizer bar to control arm attaching links.

**SERVICE PROCEDURES****LUBRICATION**

The only serviceable lubrication points on the suspension are the upper ball joints (Fig. 4). All other joints are sealed for life. Lubricate the upper ball joints until a slight swelling is noticed in the ball joint seal boots. Do not overfill the seal boots. Follow the vehicles maintenance schedule.

**REMOVAL AND INSTALLATION****SERVICE WARNINGS AND CAUTIONS**

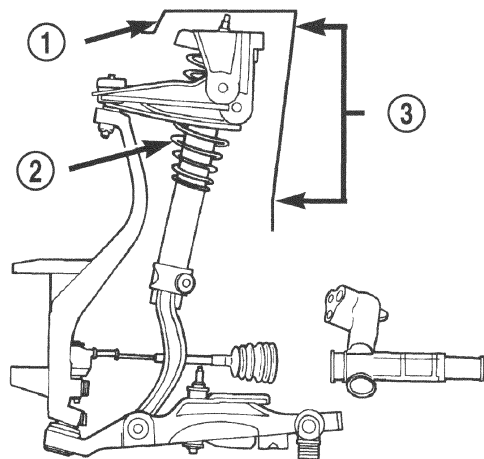
**WARNING:** DO NOT REMOVE A SHOCK ROD NUT WHILE THE SHOCK ASSEMBLY IS INSTALLED IN VEHICLE, OR BEFORE THE SHOCK ASSEMBLY SPRING IS COMPRESSED.

**CAUTION:** Only frame contact hoisting equipment can be used on this vehicle. All vehicles have a fully independent rear suspension. The vehicles can not be hoisted using equipment designed to lift a vehicle by the rear axle. If this type of hoisting equipment is used, damage to rear suspension components will occur.

**CAUTION:** At no time when servicing a vehicle, can a sheet metal screw, bolt or other metal fastener be installed in the shock tower to take the place of an original plastic clip. Also, NO holes can be drilled into the front shock tower in the area shown in (Fig. 5), for the installation of any metal fasteners into the shock tower. Because of the minimum clearance in this area installation of metal fasteners could damage the coil spring coating and lead to a corrosion failure of the spring.



## REMOVAL AND INSTALLATION (Continued)



805e2a9C

**Fig. 5 Shock Tower To Spring Minimum Clearance Area**

- 1 - SHOCK TOWER
- 2 - COIL SPRING
- 3 - NO SHEET METAL SCREWS, BOLTS, OR ANY OTHER METAL FASTENERS ARE TO BE INSTALLED IN SHOCK TOWER AREA. ALSO, NO HOLES ARE TO BE DRILLED INTO SHOCK TOWER IN THIS SAME AREA.

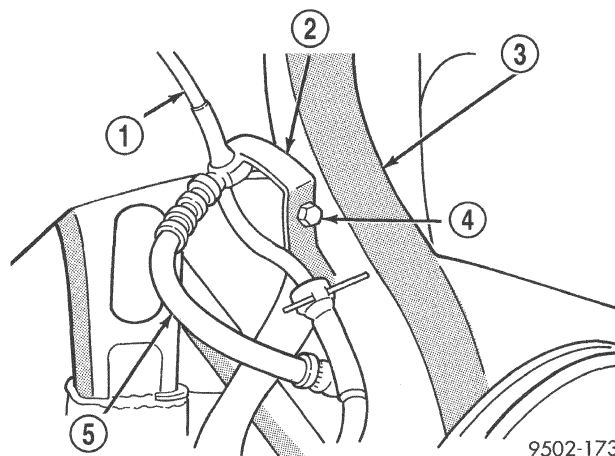
**NOTE:** If a suspension component becomes bent, damaged or fails, no attempt should be made to straighten or repair it. Always replace it with a new component.

## SHOCK ASSEMBLY (FRONT)

**NOTE:** Before proceeding, review **SERVICE WARNINGS AND CAUTIONS** in this section.

### REMOVAL

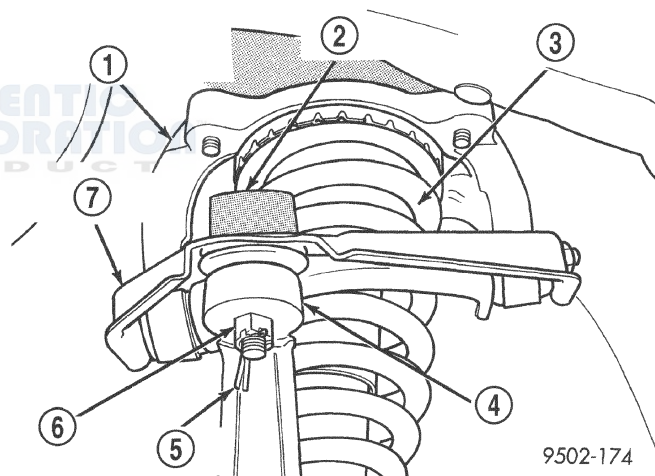
- (1) Loosen wheel nuts.
- (2) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.
- (3) Remove the wheel and tire from the location on front of vehicle requiring shock removal.
- (4) If both shock assemblies are removed, mark the shock assemblies right and left according to which side of the vehicle they were removed from.
- (5) Remove the wheel speed sensor cable routing bracket (Fig. 6) from the steering knuckle.
- (6) Remove the cotter pin and castle nut (Fig. 7) from the upper ball joint stud.
- (7) Remove the upper ball joint stud from the steering knuckle using Puller, Special Tool, C-3894-A (Fig. 8). Pull steering knuckle outward and position toward the rear of the front wheel opening.



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**Fig. 6 Wheel Speed Sensor Cable Routing Bracket**

- 1 - WHEEL SPEED SENSOR CABLE
- 2 - SPEED SENSOR CABLE ROUTING BRACKET
- 3 - STEERING KNUCKLE
- 4 - ATTACHING BOLT
- 5 - BRAKE CALIPER FLEX HOSE



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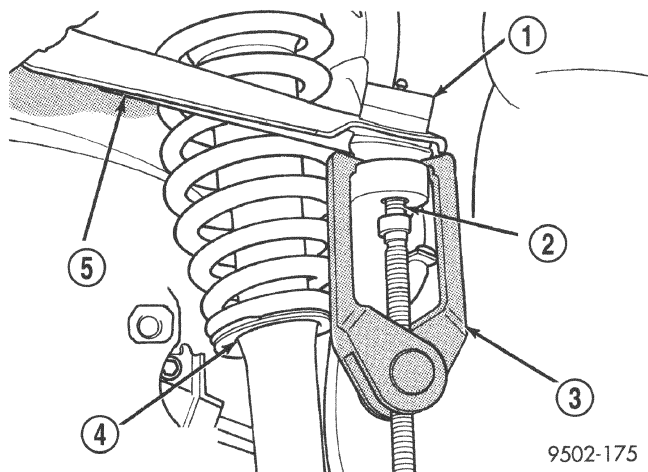
**Fig. 7 Ball Joint Attachment To Steering Knuckle**

- 1 - UPPER CONTROL ARM SHOCK ABSORBER MOUNTING BRACKET
- 2 - BALL JOINT
- 3 - SHOCK ABSORBER ASSEMBLY
- 4 - STEERING KNUCKLE
- 5 - COTTER PIN
- 6 - CASTLE NUT
- 7 - UPPER CONTROL ARM

(8) Remove pinch bolt attaching shock absorber clevis to shock absorber (Fig. 9).

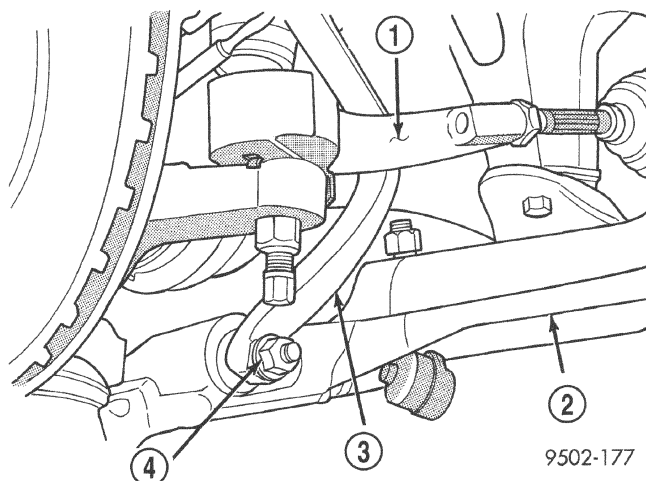
(9) Remove the nut and thru-bolt (Fig. 10) attaching the shock absorber clevis to the lower control arm.

(10) Remove the clevis from the shock absorber by carefully tapping the clevis off the shock absorber using a soft (brass) drift.

**REMOVAL AND INSTALLATION (Continued)**

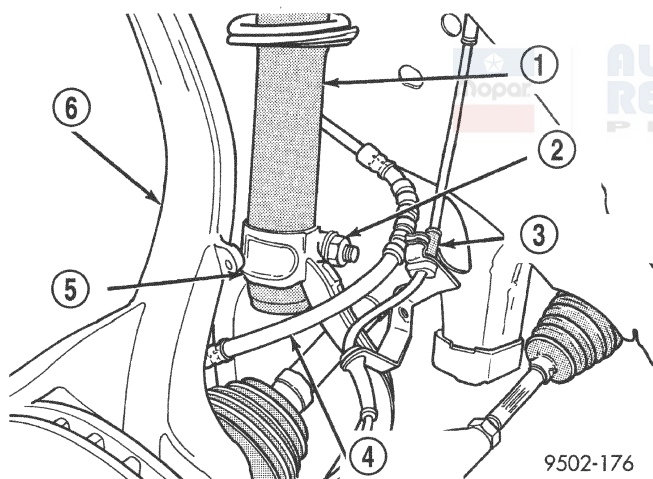
**Fig. 8 Ball Joint Stud Removal From Steering Knuckle**

- 1 – BALL JOINT
- 2 – BALL JOINT STUD
- 3 – SPECIAL TOOL C3894-A
- 4 – SHOCK ABSORBER ASSEMBLY
- 5 – UPPER CONTROL ARM



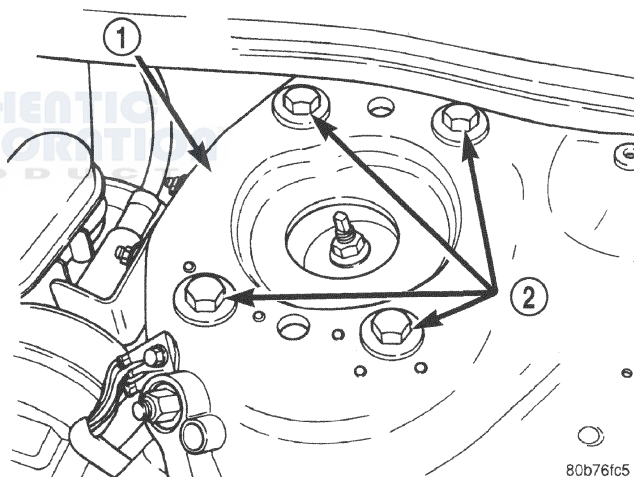
**Fig. 10 Clevis To Lower Control Arm Attaching Bolt**

- 1 – TIE ROD END
- 2 – LOWER CONTROL ARM
- 3 – SHOCK ABSORBER CLEVIS
- 4 – THRU-BOLT



**Fig. 9 Shock Absorber Clevis Bracket Pinch Bolt**

- 1 – SHOCK ABSORBER ASSEMBLY
- 2 – PINCH BOLT AND NUT
- 3 – WHEEL SPEED SENSOR CABLE
- 4 – BRAKE FLEX HOSE
- 5 – CLEVIS BRACKET
- 6 – STEERING KNUCKLE



**Fig. 11 Shock Assembly Attachment To Shock Tower**

- 1 – SHOCK TOWER
- 2 – MOUNTING BOLTS

(11) Remove the 4 bolts (Fig. 11) attaching the shock absorber/upper control arm mounting bracket to the shock tower of the vehicle.

(12) Remove the shock assembly from the vehicle. The shock assembly is removed out through the front area of the front wheel well.

(13) For disassembly and assembly of the shock assembly, refer to DISASSEMBLY AND ASSEMBLY in this section of this group.

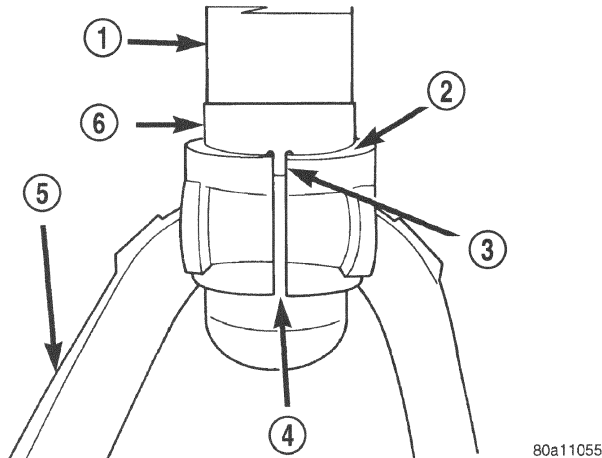
**INSTALLATION**

(1) Install the shock assembly, with the clevis removed, into shock tower. Aligning the 2 locating pins and the 4 mounting holes on the upper control arm shock absorber mount with the 4 holes in shock tower. Install the 4 upper control arm mount to shock tower mounting bolts (Fig. 11). Tighten the 4 bolts to a torque of 95 N·m (70 ft. lbs.).

(2) Install the clevis on the shock absorber. Clevis is installed by tapping it onto the fluid reservoir of the shock absorber using a soft (brass) drift until fully seated against locating tab on shock absorber

## REMOVAL AND INSTALLATION (Continued)

(Fig. 12). Orientation tab on locating tab must be positioned in the split of the clevis (Fig. 12).



**Fig. 12 Clevis Correctly Installed On Shock Absorber**

- 1 - SHOCK ABSORBER
- 2 - SHOCK CLEVIS MUST BE INSTALLED FLUSH AGAINST LOCATING TAB HERE
- 3 - ORIENTATION TAB
- 4 - CLEVIS SPLIT
- 5 - SHOCK CLEVIS
- 6 - LOCATING TAB

(3) Install the pinch bolt retaining the shock clevis to the shock absorber (Fig. 9). Tighten the pinch bolt to a torque of 88 N·m (65 ft. lbs.).

(4) Install the clevis bracket to lower control arm thru-bolt (Fig. 10). Do not tighten or torque the thru-bolt at this time.

(5) Install upper ball joint into steering knuckle. Install castle nut on ball joint stud. Tighten castle nut to a torque of 54 N·m (40 ft. lbs.). Install cotter pin in stud of ball joint (Fig. 7).

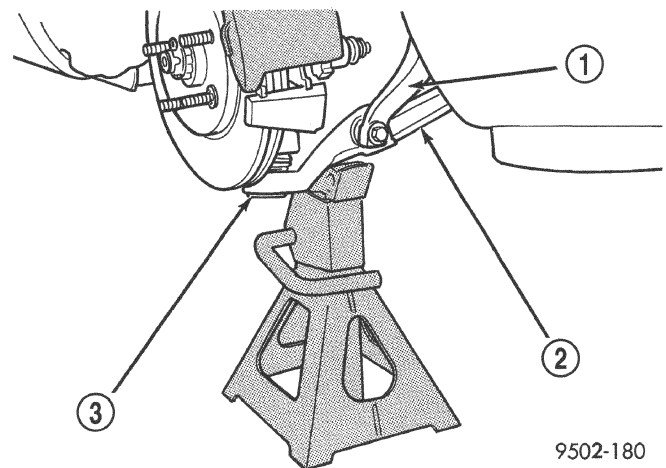
(6) Install the routing bracket for the speed control cable (Fig. 6) on the steering knuckle. Install and securely tighten the routing bracket attaching bolt (Fig. 6).

**CAUTION:** When supporting lower control arm with jack stand, do not position jack stand under the ball joint cap on the lower control arm. Position in area of lower control arm shown in (Fig. 13).

(7) Lower vehicle to the ground with a jack stand positioned under the lower control arm (Fig. 13). Continue to lower vehicle so the total weight of the vehicle is supported by the jack stand and lower control arm.

(8) Tighten the shock absorber clevis to lower control arm bushing thru-bolt nut to a torque of 88 N·m (65 ft. lbs.).

(9) Raise the vehicle, then remove the jack stand.



**Fig. 13 Lower Control Arm Correctly Supported By Jack Stand**

- 1 - SHOCK ABSORBER CLEVIS
- 2 - LOWER CONTROL ARM
- 3 - BALL JOINT CAP

(10) Install the tire and wheel assembly. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(11) Lower the vehicle.

## STEERING KNUCKLE

### REMOVAL

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove front tire and wheel assembly from the hub.

**CAUTION:** Wheel bearing damage will result if hub nut is loosened, then vehicle is rolled on the ground or the weight of the vehicle is allowed to be supported by the tires.

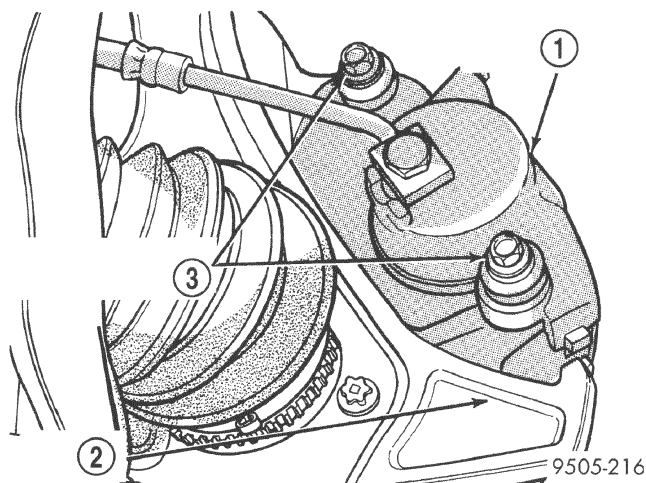
(3) Loosen hub nut with the brakes applied. **The hub and driveshaft are splined together through the knuckle (bearing) and retained by the hub nut.**

(4) Remove front disc brake caliper to steering knuckle guide pin attaching bolts (Fig. 14).

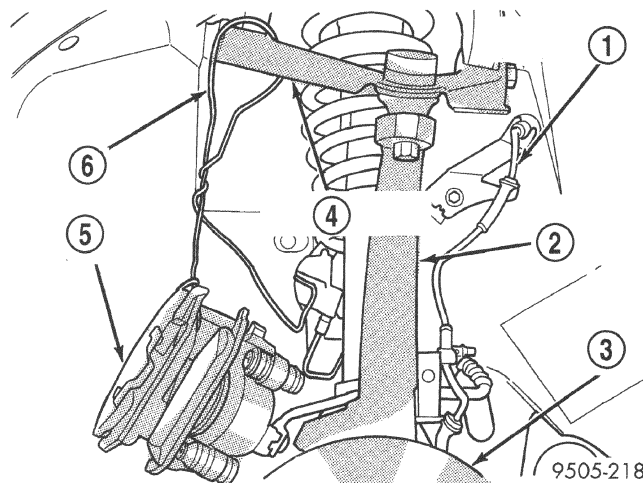
(5) Remove disc brake caliper assembly from steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then removing top of caliper out from under steering knuckle (Fig. 15).



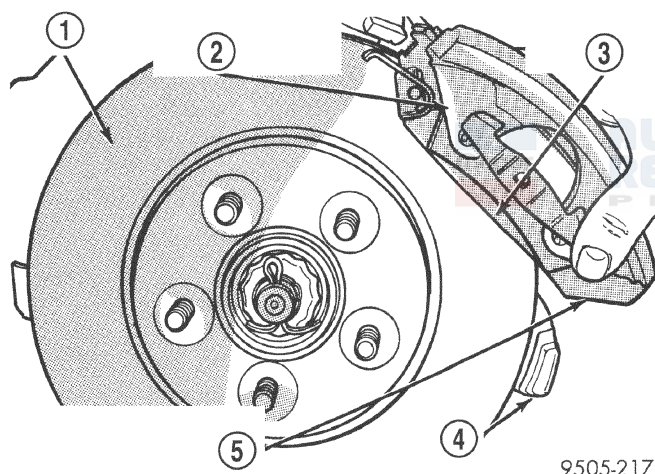
## REMOVAL AND INSTALLATION (Continued)

**Fig. 14 Front Disc Brake Caliper Mounting**

- 1 - DISC BRAKE CALIPER ASSEMBLY
- 2 - STEERING KNUCKLE
- 3 - CALIPER ASSEMBLY GUIDE PIN BOLTS

**Fig. 16 Correctly Supported Front Disc Brake Caliper**

- 1 - ABS SPEED SENSOR CABLE
- 2 - STEERING KNUCKLE
- 3 - ROTOR
- 4 - UPPER CONTROL ARM
- 5 - DISC BRAKE CALIPER ASSEMBLY
- 6 - WIRE HANGER

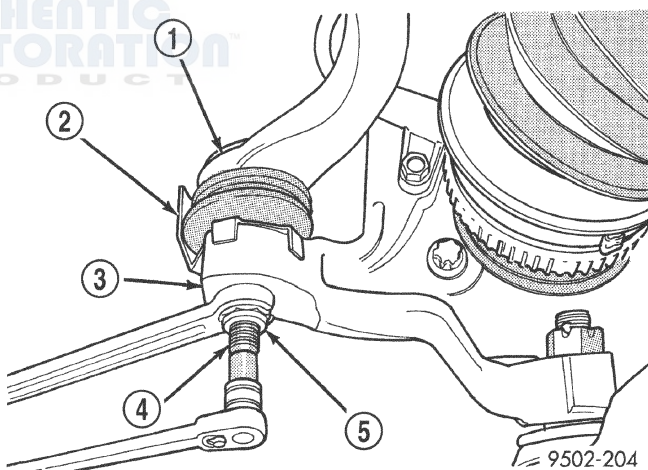
**Fig. 15 Disc Brake Caliper Removal**

- 1 - ROTOR
- 2 - DISC BRAKE CALIPER ASSEMBLY
- 3 - OUTBOARD BRAKE SHOE
- 4 - STEERING KNUCKLE
- 5 - LIFT THIS END OF CALIPER AWAY FROM STEERING KNUCKLE FIRST

(6) Support brake caliper/adapter assembly using a wire hook (Fig. 16) and not by hydraulic hose.

(7) Remove the braking disc from the front hub/bearing assembly.

(8) Remove nut attaching outer tie rod end to the steering knuckle (Fig. 17). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with wrench (Fig. 17).**

**Fig. 17 Tie Rod End Attaching Nut**

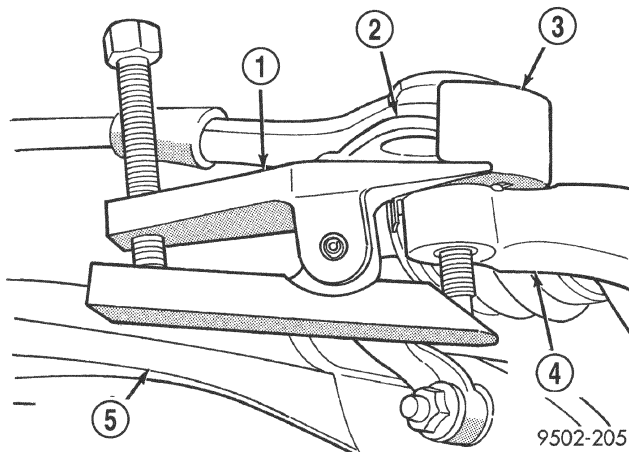
- 1 - TIE ROD END
- 2 - HEAT SHIELD
- 3 - STEERING KNUCKLE
- 4 - TIE ROD END STUD
- 5 - NUT

(9) Remove the tie rod end from the steering knuckle using Remover, Special Tool MB-991113 (Fig. 18).

(10) Remove the speed sensor cable routing bracket (Fig. 19) from the steering knuckle.

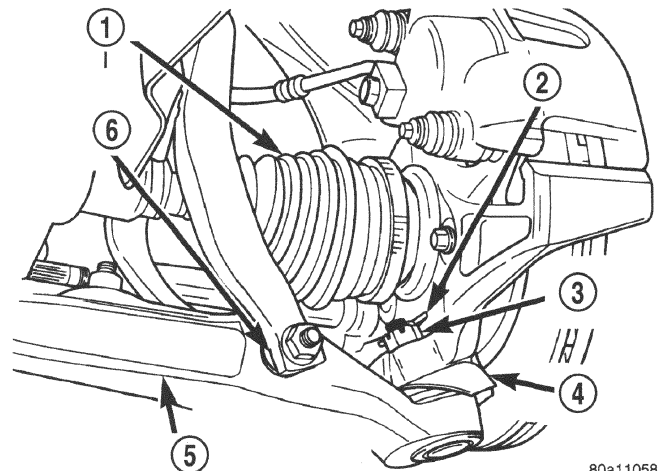
(11) Remove cotter pin and castle nut (Fig. 20) from the stud of the lower ball joint.

## REMOVAL AND INSTALLATION (Continued)



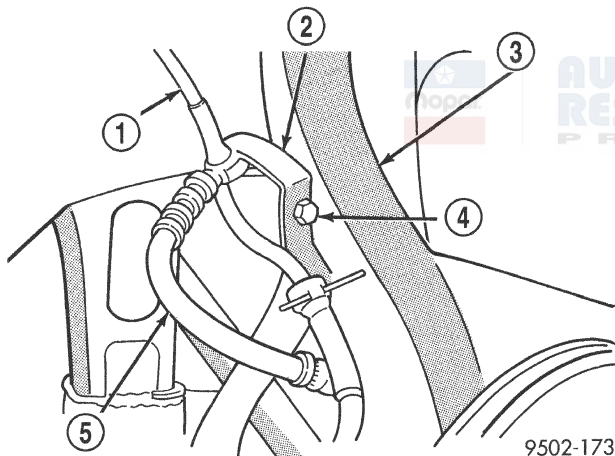
**Fig. 18 Tie Rod End Removal From Steering Knuckle**

- 1 - SPECIAL TOOL MB-991113
- 2 - TIE ROD END
- 3 - HEAT SHIELD
- 4 - STEERING KNUCKLE
- 5 - LOWER CONTROL ARM



**Fig. 20 Lower Ball Joint Attachment To Steering Knuckle**

- 1 - DRIVESHAFT
- 2 - COTTER PIN
- 3 - CASTLE NUT
- 4 - HEAT SHIELD
- 5 - LOWER CONTROL ARM
- 6 - SHOCK ABSORBER CLEVIS



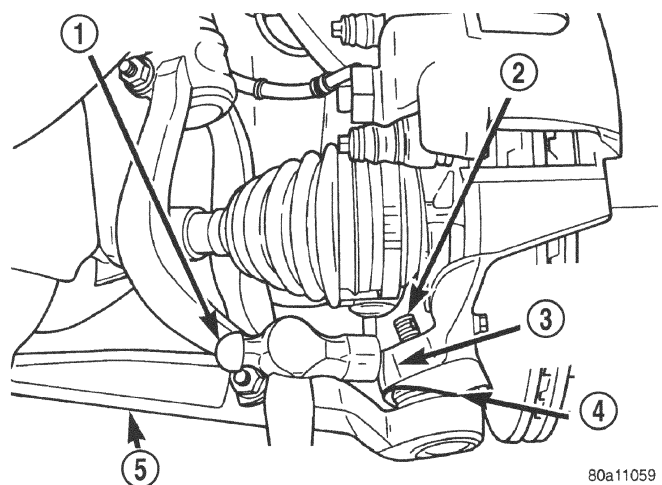
**Fig. 19 Speed Sensor Cable Routing Bracket**

- 1 - WHEEL SPEED SENSOR CABLE
- 2 - SPEED SENSOR CABLE ROUTING BRACKET
- 3 - STEERING KNUCKLE
- 4 - ATTACHING BOLT
- 5 - BRAKE CALIPER FLEX HOSE

**CAUTION:** No tool is to be inserted between the steering knuckle and the lower ball joint to separate stud of lower ball joint from the steering knuckle. The steering knuckle is to be separated from the stud of the ball joint only using the procedure as described in step Step 12 below.

**CAUTION:** When striking the steering knuckle, do not hit the heat shield covering the ball joint grease seal. Bending the heat shield against the ball joint grease seal will cause the grease seal to fail.

(12) Turn steering knuckle so the front of the steering knuckle is facing as far outboard in the wheel well as possible. Using a hammer strike the boss on the steering knuckle, (Fig. 21) until the steering knuckle separates from the stud of lower ball joint.



**Fig. 21 Separating Ball Joint Stud From Steering Knuckle**

- 1 - HAMMER
- 2 - BALL JOINT STUD
- 3 - STEERING KNUCKLE BOSS
- 4 - HEAT SHIELD
- 5 - LOWER CONTROL ARM



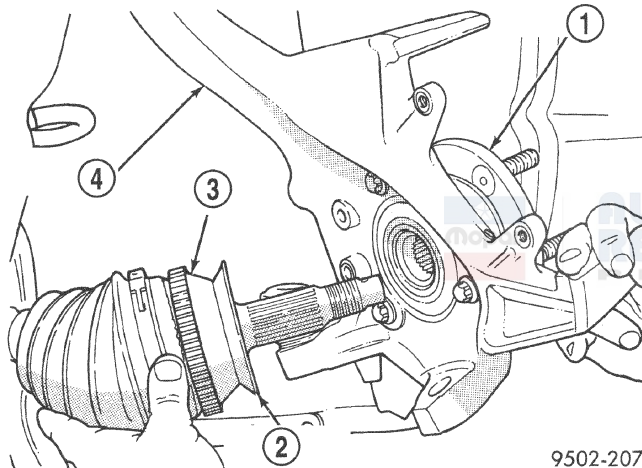
**REMOVAL AND INSTALLATION (Continued)**

**CAUTION:** Pulling steering knuckle out from vehicle after releasing from ball joint can separate inner C/V joint. See Driveshafts.

(13) Lift up on steering knuckle separating it from the lower ball joint stud. **Use caution when separating ball joint stud from steering knuckle, so ball joint seal does not get cut.**

**NOTE:** Care must be taken not to separate the inner C/V joint during this operation. Do not allow driveshaft to hang by inner C/V joint, driveshaft must be supported.

(14) Separate the steering knuckle from the outer C/V joint. Separate steering knuckle from outer C/V joint, by supporting the driveshaft while pulling steering knuckle away from the outer C/V joint (Fig. 22).



9502-207

**Fig. 22 Separating Steering Knuckle From Outer C/V Joint**

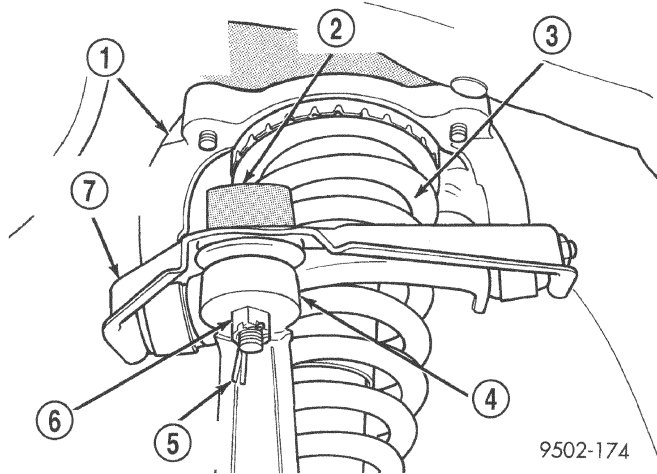
- 1 - HUB/BEARING
- 2 - BEARING SHIELD
- 3 - OUTER C/V JOINT
- 4 - STEERING KNUCKLE

(15) Remove the cotter pin and nut (Fig. 23) from the upper ball joint stud to steering knuckle attachment.

(16) Remove the upper ball joint stud from the steering knuckle using Puller, Special Tool, C-3894-A (Fig. 24).

(17) Remove steering knuckle from vehicle.

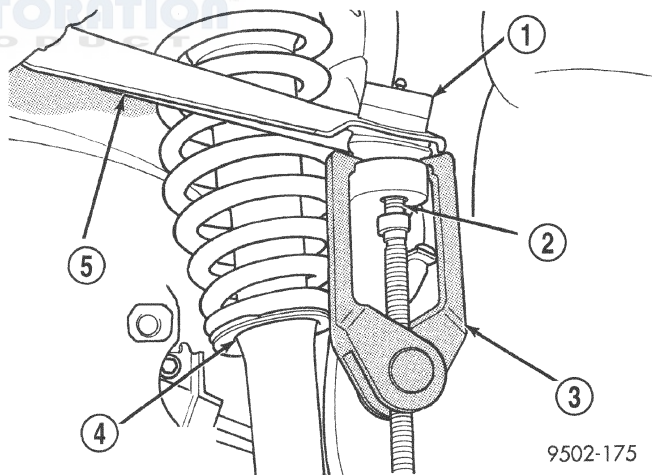
(18) **The bolt in type front wheel bearing used on the vehicle is transferable to the replacement steering knuckle if bearing is found to be in usable condition.** Refer to Hub And Bearing Service in this section of the service manual for proper wheel bearing removal and installation procedure.



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**Fig. 23 Upper Ball Joint Attachment To Steering Knuckle**

- 1 - UPPER CONTROL ARM SHOCK ABSORBER MOUNTING BRACKET
- 2 - BALL JOINT
- 3 - SHOCK ABSORBER ASSEMBLY
- 4 - STEERING KNUCKLE
- 5 - COTTER PIN
- 6 - CASTLE NUT
- 7 - UPPER CONTROL ARM



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**Fig. 24 Ball Joint Stud Removal From Steering Knuckle**

- 1 - BALL JOINT
- 2 - BALL JOINT STUD
- 3 - SPECIAL TOOL C3894-A
- 4 - SHOCK ABSORBER ASSEMBLY
- 5 - UPPER CONTROL ARM

**INSTALLATION**

(1) If required install a hub/bearing assembly into the steering knuckle before installing steering knuckle on vehicle. Refer to Hub And Bearing Service in this section of the service manual for proper wheel bearing removal and installation procedure.

## REMOVAL AND INSTALLATION (Continued)

(2) Install the heat shield for the lower control arm ball joint grease seal before beginning the installation of the steering knuckle on the vehicle.

(3) Slide drive shaft back into front hub/bearing assembly. Then install steering knuckle onto the ball joint stud in lower control arm.

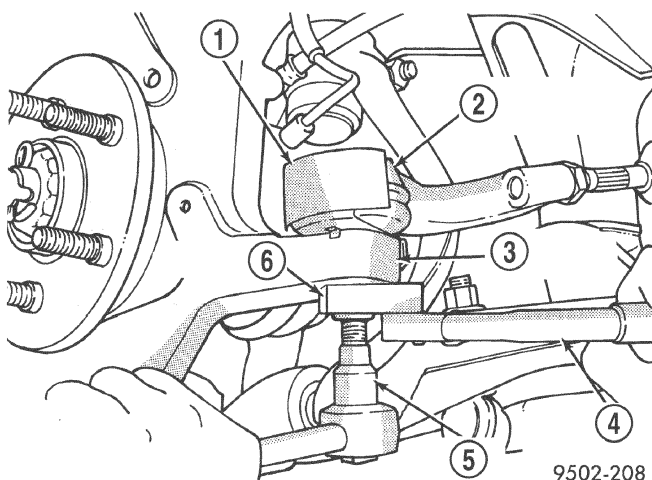
(4) Install the steering knuckle to lower ball joint stud castle nut.

(5) Install upper ball joint in steering knuckle. Install the steering knuckle to upper ball joint nut. Tighten the upper ball joint castle nut (Fig. 23) to a torque of 54 N·m (40 ft. lbs.). Then, using a crowfoot and torque wrench, tighten the lower ball joint nut (Fig. 20) to a torque of 75 N·m (55 ft. lbs.). Install cotter pins in upper and lower ball joint studs.

(6) Install the speed sensor cable routing bracket on the steering knuckle (Fig. 19) and securely tighten the attaching bolt.

**CAUTION:** When installing tie rod on steering knuckle the heat shield (Fig. 25) must be installed. If heat shield is not installed, tie rod seal boot can fail due to excessive heat from brake rotor.

(7) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 17). Then using a crowfoot and 11/32 socket tighten the attaching nut to a torque of 61 N·m (45 ft. lbs.) (Fig. 25).

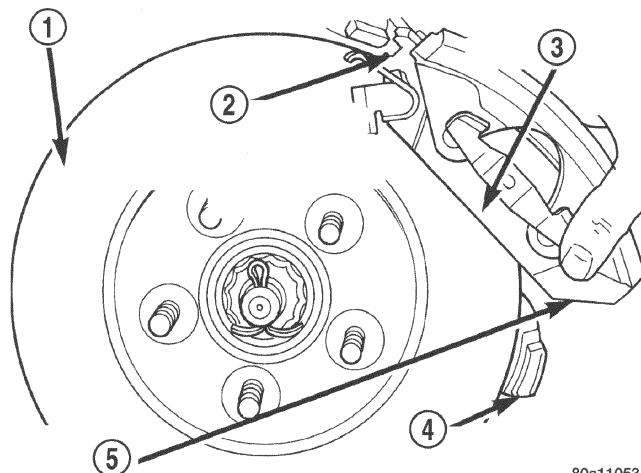


**Fig. 25 Torquing Tie Rod End Attaching Nut**

- 1 - HEAT SHIELD
- 2 - TIE ROD END
- 3 - STEERING KNUCKLE
- 4 - TORQUE WRENCH
- 5 - 11/32 SOCKET
- 6 - CROWFOOT

(8) Install braking disc back on hub and bearing assembly.

(9) Install disc brake caliper assembly on steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then installing bottom of caliper against bottom abutment of steering knuckle (Fig. 26).



**Fig. 26 Installing Brake Caliper**

- 1 - ROTOR
- 2 - INSTALL THIS END OF CALIPER UNDER STEERING KNUCKLE FIRST
- 3 - OUTBOARD BRAKE SHOE
- 4 - STEERING KNUCKLE
- 5 - DISC BRAKE CALIPER

(10) Install the disc brake caliper guide pin bolts (Fig. 14). Tighten caliper assembly guide pin bolts to a torque of 31 N·m (23 ft. lbs.).

(11) Clean all foreign matter from the threads of the outer C/V joint stub axle. Install hub nut onto driveshaft stub axle.

(12) With vehicle brakes applied to keep braking disc from turning, tighten hub nut to 142 N·m (105 ft. lbs.) of torque.

(13) Install front wheel and tire assembly. Install front wheel lug nuts and tighten in correct sequence. Then tighten to a torque of 135 N·m (100 ft. lbs.).

(14) Lower vehicle.

(15) Set front Toe on vehicle to required specification. Use procedure listed under Wheel Alignment in this service manual group.

## HUB AND BEARING (FRONT)

### REMOVAL

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove front tire and wheel assembly from the hub.

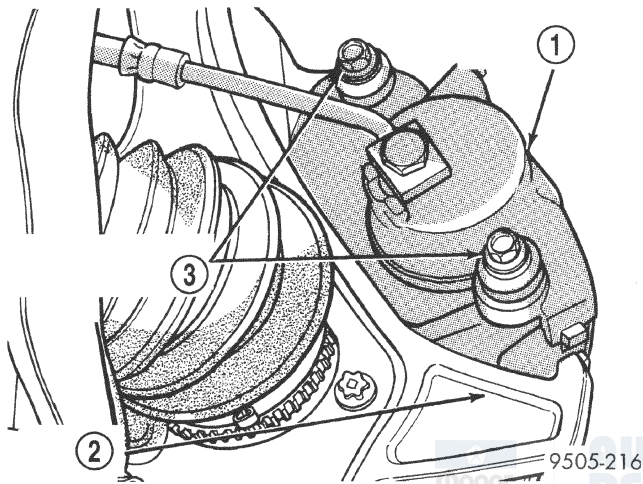


**REMOVAL AND INSTALLATION (Continued)**

**CAUTION:** Wheel bearing damage will result if hub nut is loosened, then vehicle is rolled on the ground or the weight of the vehicle is allowed to be supported by the tires.

(3) Loosen hub nut with the brakes applied. **The hub and driveshaft are splined together through the knuckle (bearing) and retained by the hub nut.**

(4) Remove front disc brake caliper to steering knuckle guide pin attaching bolts (Fig. 27).



**Fig. 27 Front Disc Brake Caliper Mounting**

- 1 - DISC BRAKE CALIPER ASSEMBLY
- 2 - STEERING KNUCKLE
- 3 - CALIPER ASSEMBLY GUIDE PIN BOLTS

(5) Remove disc brake caliper assembly from steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then removing top of caliper out from under steering knuckle (Fig. 28).

(6) Support brake caliper/adapter assembly using a wire hook (Fig. 29) and not by hydraulic hose.

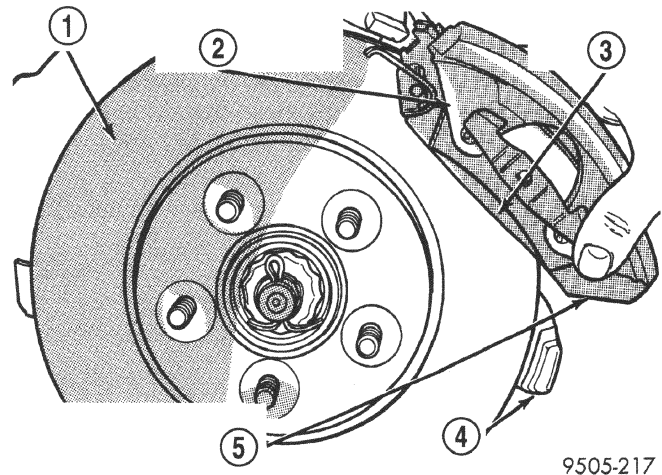
(7) Remove the braking disc from the front hub/bearing assembly (Fig. 30).

(8) Remove nut attaching the outer tie rod end to the steering knuckle (Fig. 31). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with wrench (Fig. 31).**

(9) Remove the tie rod end from the steering knuckle arm, using Remover, Special Tool MB-991113 (Fig. 32).

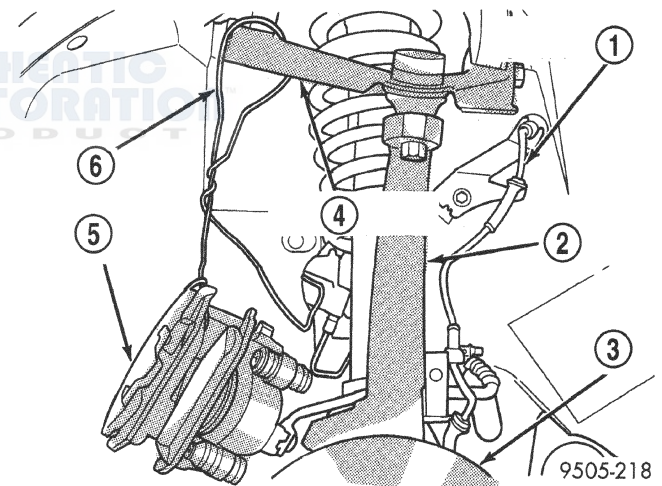
(10) If equipped with antilock brakes remove the speed sensor cable routing bracket (Fig. 33) from the steering knuckle.

(11) Remove cotter pin and castle nut (Fig. 34) from the stud of the lower ball joint.



**Fig. 28 Caliper Removal From Steering Knuckle**

- 1 - ROTOR
- 2 - DISC BRAKE CALIPER ASSEMBLY
- 3 - OUTBOARD BRAKE SHOE
- 4 - STEERING KNUCKLE
- 5 - LIFT THIS END OF CALIPER AWAY FROM STEERING KNUCKLE FIRST

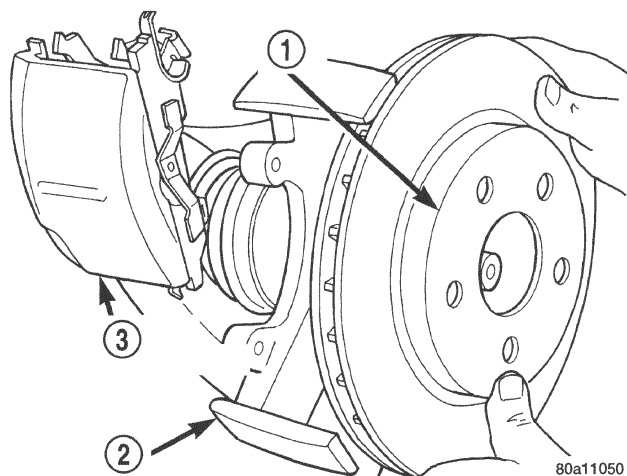


**Fig. 29 Correctly Supported Front Disc Brake Caliper**

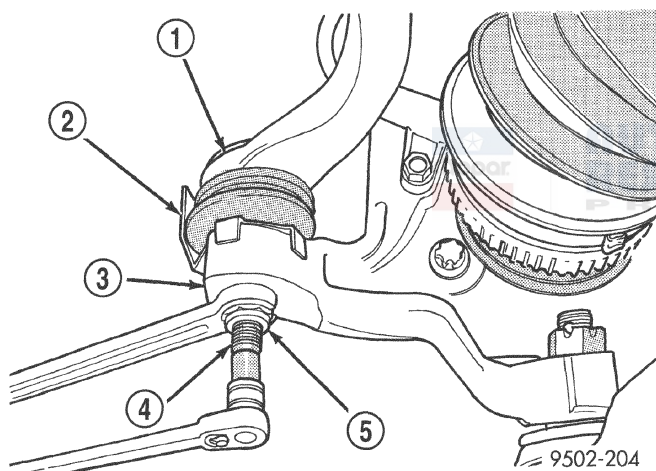
- 1 - ABS SPEED SENSOR CABLE
- 2 - STEERING KNUCKLE
- 3 - ROTOR
- 4 - UPPER CONTROL ARM
- 5 - DISC BRAKE CALIPER ASSEMBLY
- 6 - WIRE HANGER

**CAUTION:** No tool is to be inserted between the steering knuckle and the lower ball joint to separate stud of lower ball joint from the steering knuckle. The steering knuckle is to be separated from the stud of the ball joint only using the procedure as described in step Step 12 below.

## REMOVAL AND INSTALLATION (Continued)

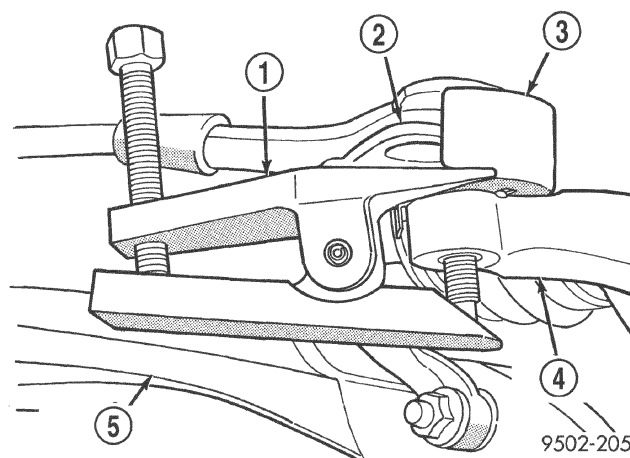
**Fig. 30 Removing/Installing Front Braking Disc**

- 1 - BRAKING DISC
- 2 - STEERING KNUCKLE
- 3 - DISC BRAKE CALIPER ASSEMBLY (STORED)

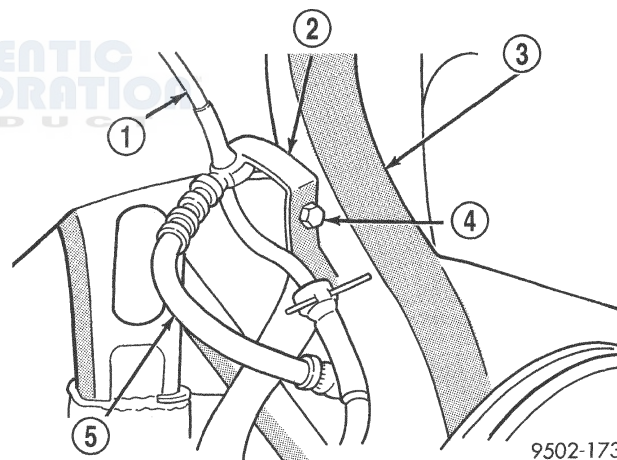
**Fig. 31 Tie Rod End Attaching Nut Removal/Installation**

- 1 - TIE ROD END
- 2 - HEAT SHIELD
- 3 - STEERING KNUCKLE
- 4 - TIE ROD END STUD
- 5 - NUT

(12) Turn steering knuckle so the front of the steering knuckle is facing as far outboard in the wheel well as possible. Using a hammer strike the boss on the steering knuckle, (Fig. 35) until steering knuckle separates from stud of lower ball joint. **When striking steering knuckle, care MUST be taken not to hit lower control arm or ball joint grease seal.**

**Fig. 32 Tie Rod End Removal From Steering Knuckle**

- 1 - SPECIAL TOOL MB-991113
- 2 - TIE ROD END
- 3 - HEAT SHIELD
- 4 - STEERING KNUCKLE
- 5 - LOWER CONTROL ARM

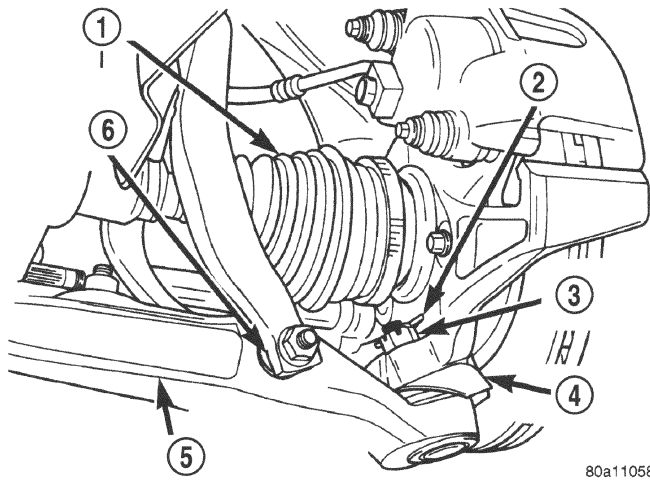
**Fig. 33 Speed Sensor Cable Routing Bracket**

- 1 - WHEEL SPEED SENSOR CABLE
- 2 - SPEED SENSOR CABLE ROUTING BRACKET
- 3 - STEERING KNUCKLE
- 4 - ATTACHING BOLT
- 5 - BRAKE CALIPER FLEX HOSE

**CAUTION:** Pulling steering knuckle out from vehicle after releasing from ball joint can separate inner C/V joint. See Driveshafts.

(13) Lift up on steering knuckle separating it from the lower ball joint stud. Use caution when separating ball joint stud from steering knuckle, so ball joint seal does not get cut.

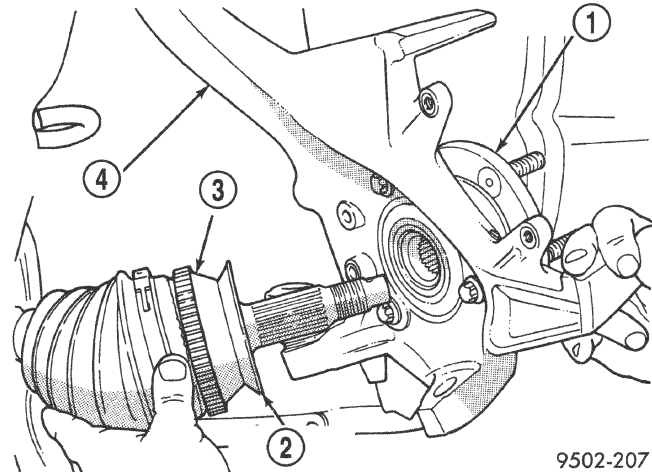


**REMOVAL AND INSTALLATION (Continued)**

**Fig. 34 Lower Ball Joint Attachment To Steering Knuckle**

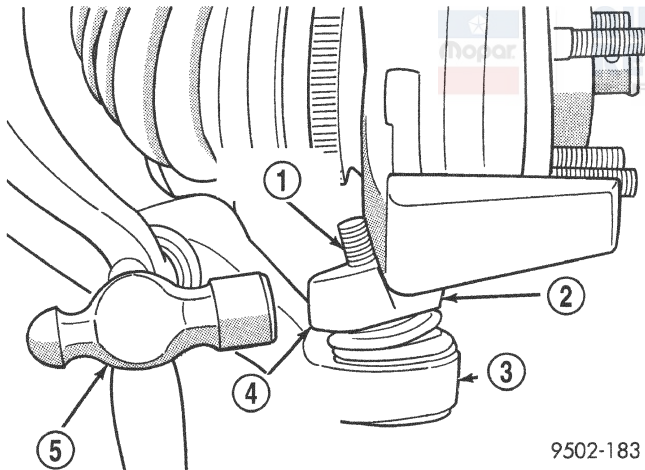
- 1 - DRIVESHAFT
- 2 - COTTER PIN
- 3 - CASTLE NUT
- 4 - HEAT SHIELD
- 5 - LOWER CONTROL ARM
- 6 - SHOCK ABSORBER CLEVIS

steering knuckle away from the outer C/V joint (Fig. 36).



**Fig. 36 Separating Steering Knuckle From Outer C/V Joint**

- 1 - HUB/BEARING
- 2 - BEARING SHIELD
- 3 - OUTER C/V JOINT
- 4 - STEERING KNUCKLE



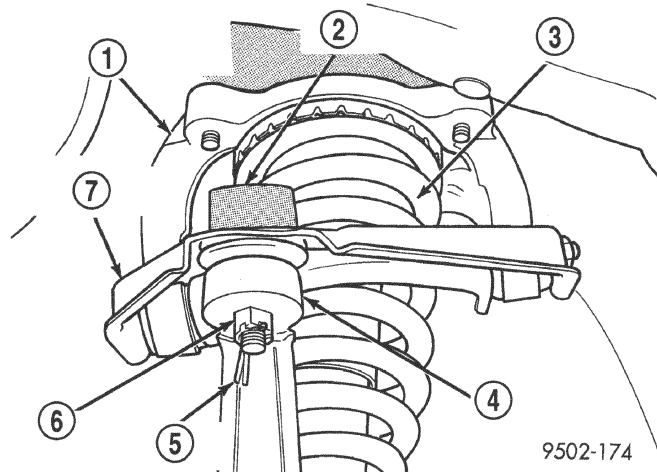
**Fig. 35 Separating Ball Joint Stud From Steering Knuckle**

- 1 - BALL JOINT STUD
- 2 - STEERING KNUCKLE
- 3 - LOWER CONTROL ARM
- 4 - STEERING KNUCKLE BOSS
- 5 - HAMMER

**NOTE:** Care must be taken not to separate the inner C/V joint during this operation. Do not allow driveshaft to hang by inner C/V joint, driveshaft must be supported.

(14) Separate the steering knuckle from the outer C/V joint. Separate steering knuckle from outer C/V joint, by supporting the driveshaft while pulling

(15) Remove the cotter pin and nut (Fig. 37) from the upper ball joint stud to steering knuckle attachment.



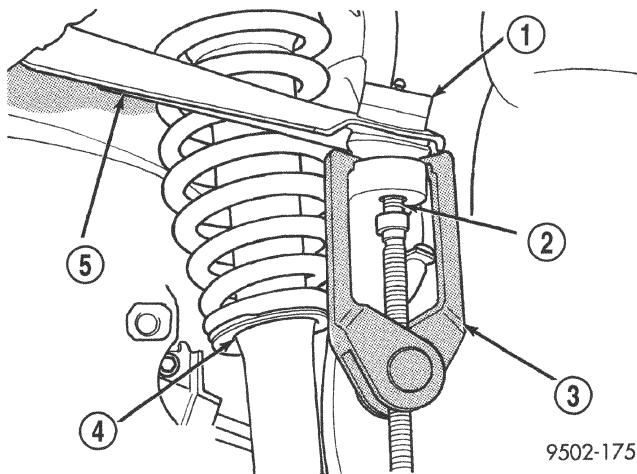
**Fig. 37 Upper Ball Joint Attachment To Steering Knuckle**

- 1 - UPPER CONTROL ARM SHOCK ABSORBER MOUNTING BRACKET
- 2 - BALL JOINT
- 3 - SHOCK ABSORBER ASSEMBLY
- 4 - STEERING KNUCKLE
- 5 - COTTER PIN
- 6 - CASTLE NUT
- 7 - UPPER CONTROL ARM



## REMOVAL AND INSTALLATION (Continued)

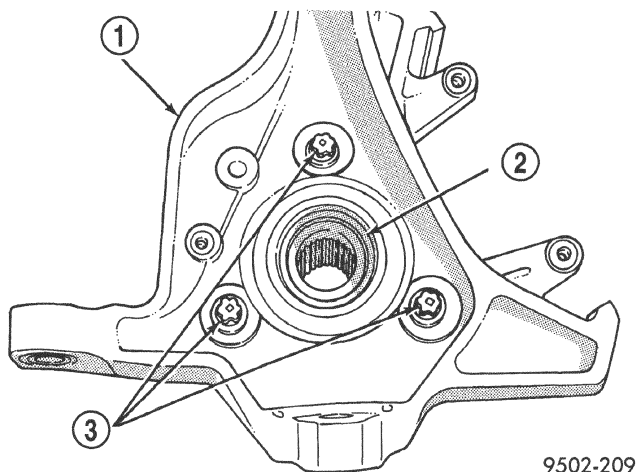
(16) Remove the upper ball joint stud from the steering knuckle using Puller, Special Tool, C3894-A (Fig. 38).



**Fig. 38 Ball Joint Stud Removal From Steering Knuckle**

- 1 - BALL JOINT
- 2 - BALL JOINT STUD
- 3 - SPECIAL TOOL C3894-A
- 4 - SHOCK ABSORBER ASSEMBLY
- 5 - UPPER CONTROL ARM

- (17) Remove steering knuckle from vehicle.
- (18) Mount steering knuckle securely in a vise.
- (19) Remove the 3 bolts (Fig. 39) attaching the hub/bearing assembly to the steering knuckle.



**Fig. 39 Hub/Bearing Attaching Bolts**

- 1 - STEERING KNUCKLE
- 2 - HUB/BEARING ASSEMBLY
- 3 - HUB/BEARING ATTACHING BOLTS

- (20) Remove the hub and bearing assembly out from the front of the steering knuckle.

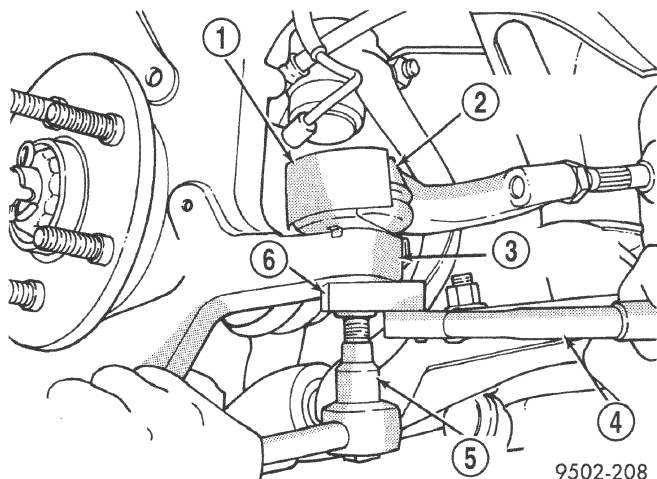
**NOTE:** If bearing will not come out of steering knuckle, it can be tapped out using a soft faced hammer.

## INSTALLATION

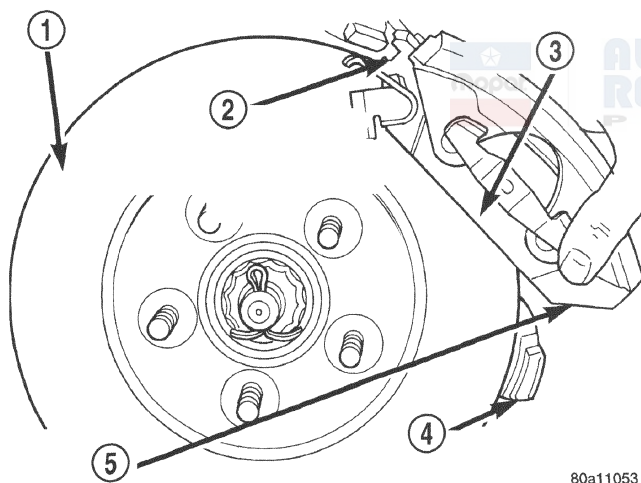
- (1) Thoroughly clean all hub and bearing assembly mounting surfaces on steering knuckle.
- (2) Install the replacement hub and bearing assembly in steering knuckle aligning bolt holes in bearing flange with holes in steering knuckle.
- (3) Install the 3 mounting bolts (Fig. 39) and tighten evenly to ensure bearing is square to face of steering knuckle. The tighten the 3 mounting bolts (Fig. 39) to a torque of 110 N·m (80 ft. lbs.).
- (4) Slide drive shaft back into front hub and bearing assembly.
- (5) Install the steering knuckle on the lower control arm ball joint.
- (6) Install the steering knuckle to lower ball joint castle nut.
- (7) Install upper ball joint stud in steering knuckle.
- (8) Install the steering knuckle to upper ball joint castle nut.
- (9) Using a crow foot and torque wrench, tighten the upper and lower ball joint castle nuts to the following torque specifications.
  - Lower ball joint castle nut 74 N·m (55 ft. lbs.).
  - Upper ball joint castle nut 62 N·m (45 ft. lbs.).
- (10) If equipped with antilock brakes install the speed sensor cable routing bracket on the steering knuckle (Fig. 33) and securely tighten attaching bolt.

**CAUTION:** When installing tie rod on steering knuckle the heat shield (Fig. 40) must be installed. If heat shield is not installed, tie rod seal boot can fail due to excessive heat from brake rotor.

- (11) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding the stud of the tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 31). Then using a crowfoot and 11/32 socket tighten the attaching nut to a torque of 61 N·m (45 ft. lbs.) (Fig. 40).
- (12) Install rotor on hub and bearing.
- (13) Install disc brake caliper assembly on steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then installing bottom of caliper against bottom abutment of steering knuckle (Fig. 41).
- (14) Install disc brake caliper assembly to steering knuckle guide pin bolts (Fig. 27). Tighten caliper assembly guide pin bolts to a torque of 31 N·m (23 ft. lbs.).

**REMOVAL AND INSTALLATION (Continued)****Fig. 40 Torquing Tie Rod End Attaching Nut**

- 1 - HEAT SHIELD
- 2 - TIE ROD END
- 3 - STEERING KNUCKLE
- 4 - TORQUE WRENCH
- 5 - 11/32 SOCKET
- 6 - CROWFOOT

**Fig. 41 Installing Brake Caliper**

- 1 - ROTOR
- 2 - INSTALL THIS END OF CALIPER UNDER STEERING KNUCKLE FIRST
- 3 - OUTBOARD BRAKE SHOE
- 4 - STEERING KNUCKLE
- 5 - DISC BRAKE CALIPER

(15) Clean all foreign matter from the threads of the outer C/V joint stub axle. Install hub nut onto the driveshaft stub axle.

(16) With vehicle brakes applied to keep stub axle from turning, tighten hub nut to a torque of 142 N·m (105 ft. lbs.) of torque.

(17) Install front wheel and tire assembly. Install front wheel lug nuts and tighten in correct sequence. Tighten nuts to a torque of 135 N·m (100 ft.lbs.).

(18) Lower vehicle.

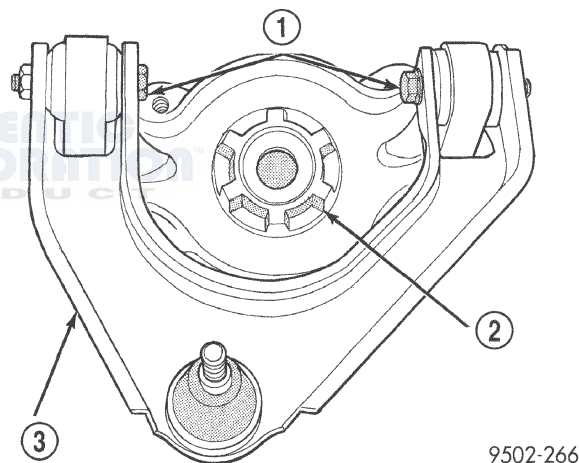
(19) Set front toe on vehicle to required specification. Use procedure listed under WHEEL ALIGNMENT, in the SUSPENSION group of this service manual.

**UPPER CONTROL ARM (FRONT)****REMOVAL**

(1) Remove the front shock assembly from the vehicle. Refer to SHOCK ASSEMBLY (FRONT) in this section for the required procedure.

(2) Disassemble the shock assembly until the upper (shock absorber/upper control arm) mounting bracket is removed from the coil spring. Refer to SHOCK ASSEMBLY (FRONT) in the DISASSEMBLY AND ASSEMBLY section of this group for the required procedure.

(3) Remove the 2 bolts attaching the upper control arm to the bushings in the upper mounting bracket (Fig. 42).

**Fig. 42 Upper Control Arm To Mounting Bracket Attachment**

- 1 - CONTROL ARM MOUNTING BOLTS
- 2 - UPPER CONTROL ARM MOUNTING BRACKET
- 3 - UPPER CONTROL ARM

(4) Remove the upper control arm from the mounting bracket.

**INSTALLATION**

(1) Install the upper control arm on the upper (shock absorber/upper control arm) mounting bracket.

(2) Install the 2 bolts attaching the upper control arm to the bushings in the mounting bracket (Fig. 42). The bolts must be installed from center, so the heads are toward the coil spring when it is installed. **The bolts MUST be installed so the head of the bolt will be toward the coil spring when the**



## REMOVAL AND INSTALLATION (Continued)

mounting bracket is installed on shock absorber (Fig. 42).

**CAUTION:** For clearance reasons the control arm mounting bolts must be installed from center, so the heads are toward the coil spring when it is installed. Otherwise the bolts may rub the coil spring, damaging it.

(3) Install the control arm mounting bolt nuts. Position the control arm at a 90 degree angle to the mounting bracket and tighten the bolts to a torque of 90 N·m (66 ft. lbs.).

(4) Reinstall the upper mounting bracket and control arm on the coil spring. Reassemble the front shock assembly. Refer to SHOCK ASSEMBLY (FRONT) in the DISASSEMBLY AND ASSEMBLY section of this group for the required procedure.

(5) Reinstall the front shock assembly on the vehicle. Refer to SHOCK ASSEMBLY (FRONT) in this section for the required installation procedure.

## LOWER CONTROL ARM

### REMOVAL

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel from the vehicle.

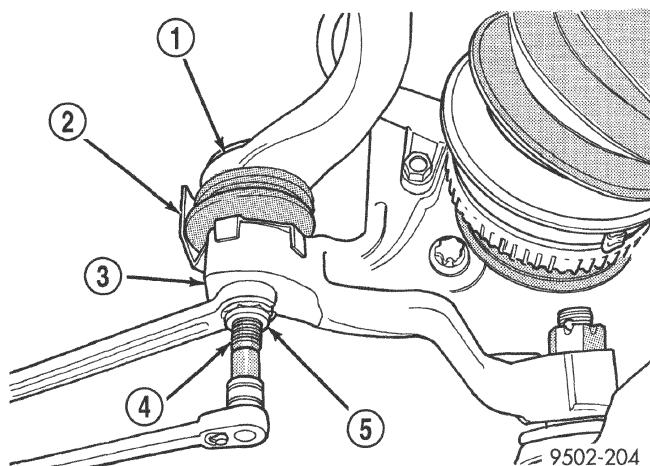
**NOTE:** Removing the tie rod end from the steering knuckle allows the steering knuckle to be turned further. This allows better access to the steering knuckle when striking it to remove the ball joint stud from the steering knuckle.

(3) Remove nut attaching the outer tie rod end to the steering knuckle (Fig. 43). Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with wrench (Fig. 43).

(4) Remove the tie rod end from the steering knuckle using Remover, Special Tool MB-991113 (Fig. 44).

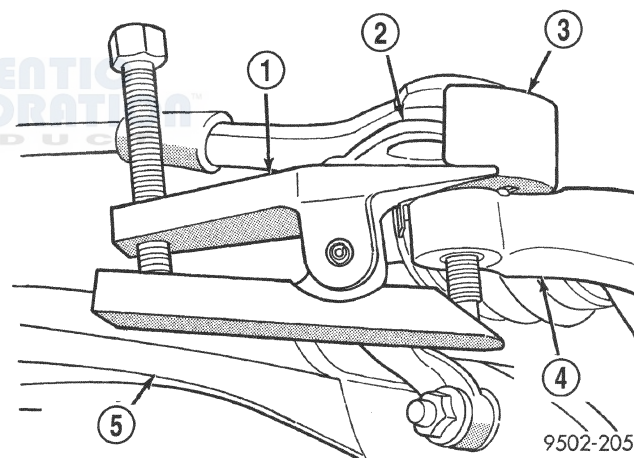
(5) Remove cotter pin and castle nut (Fig. 45) from stud of lower ball joint.

**CAUTION:** No tool is to be inserted between the steering knuckle and the lower ball joint to separate the lower ball joint from the steering knuckle. The steering knuckle is to be separated from the ball joint only using the procedure as described in step Step 6 below.



**Fig. 43 Tie Rod End Attaching Nut**

- 1 - TIE ROD END
- 2 - HEAT SHIELD
- 3 - STEERING KNUCKLE
- 4 - TIE ROD END STUD
- 5 - NUT



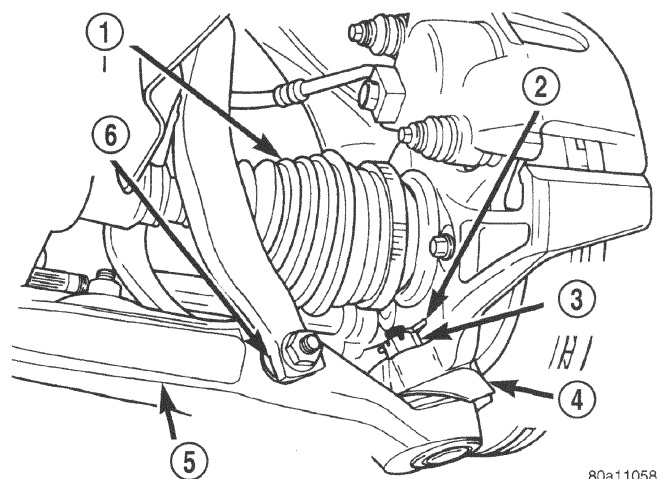
**Fig. 44 Tie Rod End Removal From Steering Knuckle**

- 1 - SPECIAL TOOL MB-991113
- 2 - TIE ROD END
- 3 - HEAT SHIELD
- 4 - STEERING KNUCKLE
- 5 - LOWER CONTROL ARM

**CAUTION:** When striking the steering knuckle, do not hit the heat shield covering the ball joint grease seal. Bending the heat shield against the ball joint grease seal will cause the grease seal to fail.

(6) Turn steering knuckle so the front of the steering knuckle is facing as far outboard in the wheel opening as possible (Fig. 46). Using a hammer, strike steering knuckle boss (Fig. 46) until steering knuckle separates from the lower ball joint. **When striking**

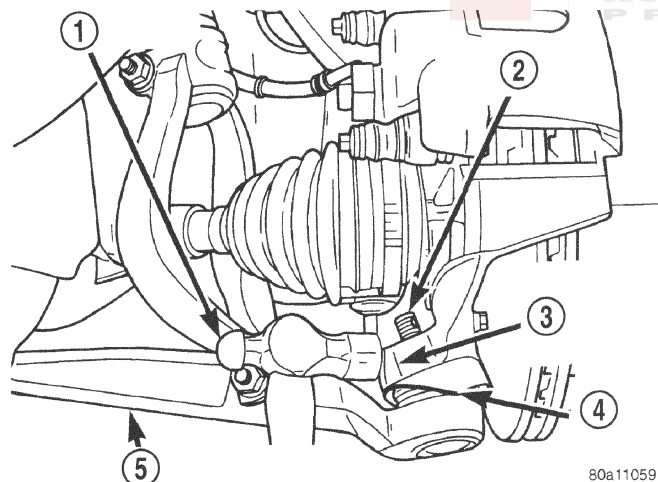


**REMOVAL AND INSTALLATION (Continued)**

**Fig. 45 Lower Ball Joint Attachment To Steering Knuckle**

- 1 - DRIVESHAFT
- 2 - COTTER PIN
- 3 - CASTLE NUT
- 4 - HEAT SHIELD
- 5 - LOWER CONTROL ARM
- 6 - SHOCK ABSORBER CLEVIS

steering knuckle care **MUST** be taken not to hit lower control arm or ball joint grease seal.

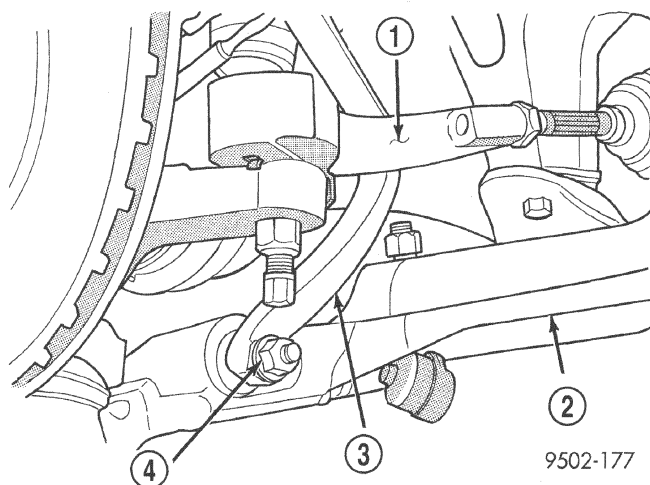


**Fig. 46 Separating Lower Ball Joint Stud From Steering Knuckle**

- 1 - HAMMER
- 2 - BALL JOINT STUD
- 3 - STEERING KNUCKLE BOSS
- 4 - HEAT SHIELD
- 5 - LOWER CONTROL ARM

**CAUTION:** Pulling the steering knuckle outward from the vehicle after releasing it from the ball joint, can separate inner C/V joint. See Driveshafts.

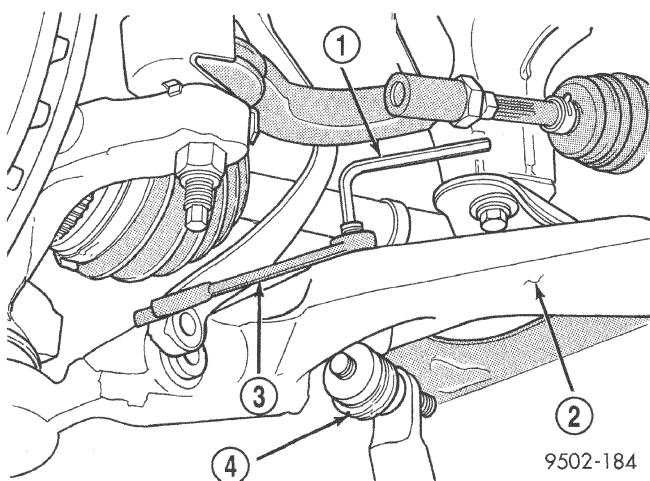
(7) Remove the shock absorber clevis to lower control arm bushing, nut and thru-bolt. Separate the clevis from lower control arm (Fig. 47).



**Fig. 47 Clevis To Lower Control Arm Attachment**

- 1 - TIE ROD END
- 2 - LOWER CONTROL ARM
- 3 - SHOCK ABSORBER CLEVIS
- 4 - THRU-BOLT

(8) Remove nut attaching the stabilizer bar link to the lower control arm (Fig. 48). When removing nut, hold stud of stabilizer bar link from turning by inserting an allen wrench in the end of the stud (Fig. 48).

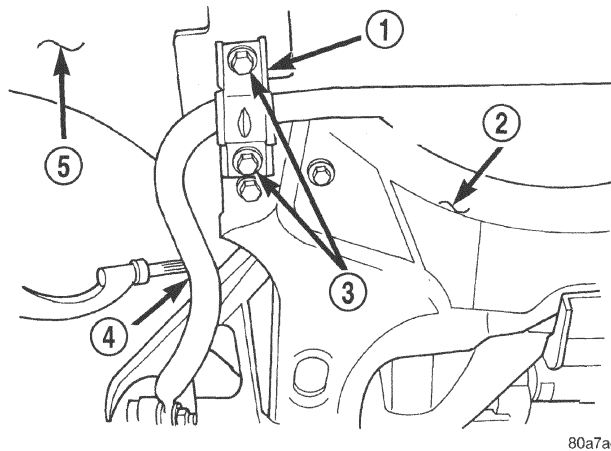


**Fig. 48 Removing/Installing Nut From Stud Of Stabilizer Link**

- 1 - ALLEN WRENCH
- 2 - LOWER CONTROL ARM
- 3 - WRENCH
- 4 - STABILIZER BAR LINK ASSEMBLY

## REMOVAL AND INSTALLATION (Continued)

(9) Remove the bolts (Fig. 49) attaching the one stabilizer bar bushing clamp to the front suspension crossmember and the body of the vehicle.



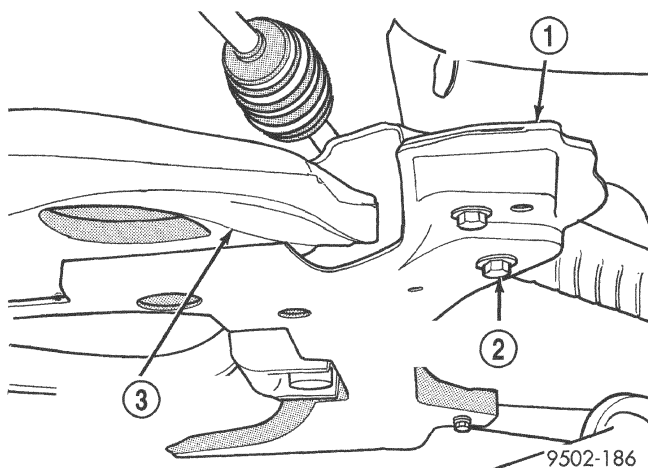
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**Fig. 49 Stabilizer Bar Bushing Clamp Attachment To Vehicle**

- 1 - STABILIZER BAR BUSHING CLAMP
- 2 - FRONT SUSPENSION CROSSMEMBER
- 3 - ATTACHING BOLTS
- 4 - STABILIZER BAR
- 5 - VEHICLE BODY

(10) Lower the one side of the stabilizer bar away from the lower control arm and body of vehicle.

(11) Remove the nut and bolt (Fig. 50) attaching the rear of the lower control arm to the front suspension crossmember.

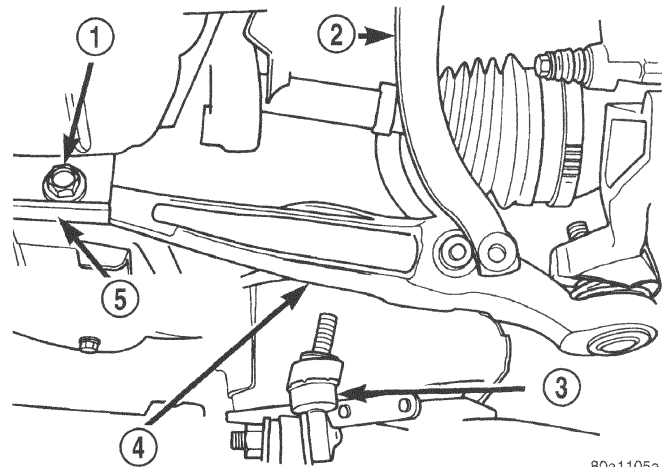


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**Fig. 50 Lower Control Arm Attachment To Front Suspension Crossmember**

- 1 - FRONT SUSPENSION CROSSMEMBER
- 2 - LOWER CONTROL ARM ATTACHING BOLT AND NUT
- 3 - LOWER CONTROL ARM

(12) Remove nut and bolt attaching the front of the lower control arm to the front suspension crossmember (Fig. 51).



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**Fig. 51 Attaching Front Of Lower Control Arm To Suspension Crossmember**

- 1 - ATTACHING BOLT AND NUT
- 2 - SHOCK CLEVIS
- 3 - STABILIZER BAR
- 4 - LOWER CONTROL ARM
- 5 - FRONT SUSPENSION CROSSMEMBER

**CAUTION:** When removing lower control arm from crossmember care must be taken to prevent hitting lower ball joint seal against steering knuckle, causing damage to the ball joint seal.

(13) Remove the front of the lower control arm from the front suspension crossmember first.

(14) Then, remove the rear of the lower control arm from the front suspension crossmember. When removing rear of lower control arm from crossmember, keep control arm as level as possible. This will keep rear bushing from binding on crossmember making it easier to remove control arm from crossmember.

## INSTALLATION

(1) Position rear of lower control arm into front suspension crossmember first. Then install front of lower control arm in front suspension crossmember. Install bolts and nuts (Fig. 51) and (Fig. 50) attaching the front and rear of lower control arm to front suspension crossmember. **Do not tighten front attaching bolt at this time.**

(2) Tighten lower control arm rear attaching nut and bolt (Fig. 50) to a torque of 95 N·m (70 ft. lbs.).

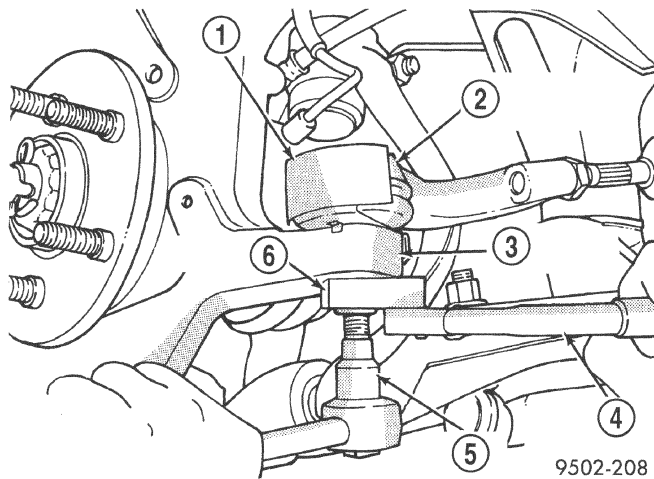
(3) Install the lower control arm ball joint stud into the steering knuckle. Install the steering knuckle to ball joint stud castle nut (Fig. 45).

(4) Install the tie rod end into the steering knuckle. Start the tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 43). Then using



**REMOVAL AND INSTALLATION (Continued)**

a crowfoot and 11/32 socket tighten the attaching nut to a torque of 61 N·m (45 ft. lbs.) (Fig. 52).



**Fig. 52 Torquing Tie Rod End Attaching Nut**

- 1 - HEAT SHIELD
- 2 - TIE ROD END
- 3 - STEERING KNUCKLE
- 4 - TORQUE WRENCH
- 5 - 11/32 SOCKET
- 6 - CROWFOOT

(5) Tighten the lower control arm ball joint stud castle nut (Fig. 45) to a torque of 74 N·m (55 ft. lbs.). Install the cotter pin (Fig. 45) in the ball joint stud.

(6) Position sway bar link into its lower control arm mounting hole.

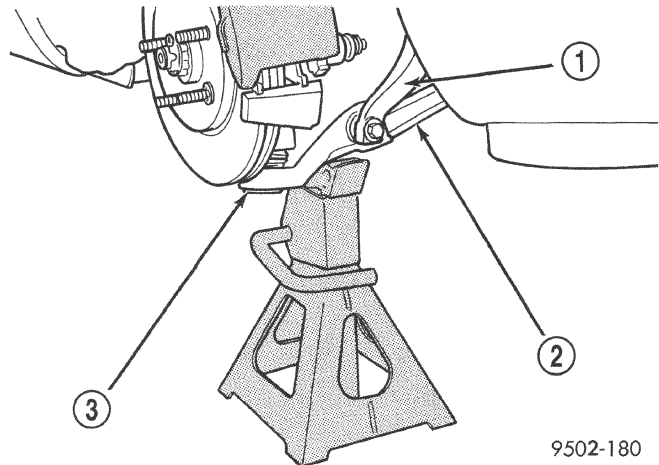
(7) Align sway bar bushing clamp with mounting holes in front suspension crossmember and body of vehicle. Then install and securely tighten the bushing clamp mounting bolts (Fig. 49) to a torque of 61 N·m (45 ft. lbs.).

(8) Install and securely tighten the stabilizer bar link to lower control arm attaching nut to a torque of 102 N·m (75 ft. lbs.). When tightening and torquing attaching nut, hold stud of attaching link from turning with an allen wrench (Fig. 48).

(9) Install the clevis on the lower control arm. Loosely install the clevis to bushing thru-bolt (Fig. 47).

**CAUTION:** When supporting lower control arm with jack stand, do not position jack stand under the ball joint cap on the lower control arm. Position in area of lower control arm shown in (Fig. 53).

(10) Lower vehicle to the ground with a jack stand positioned under the lower control arm (Fig. 53). Continue to lower vehicle so the total weight of the vehicle is supported by the jack stand and lower control arm.



**Fig. 53 Supporting Lower Control Arm With Jack Stand**

- 1 - SHOCK ABSORBER CLEVIS
- 2 - LOWER CONTROL ARM
- 3 - BALL JOINT CAP

**CAUTION:** When tightening the thru-bolt do not turn the bolt in the clevis. The serrations on the bolt and the hole in the clevis will be damaged.

(11) **With the vehicle's suspension at curb height,** tighten the clevis to lower control arm bushing thru-bolt nut (Fig. 47) to a torque of 88 N·m (65 ft. lbs.).

(12) Tighten front lower control arm nut and bolt (Fig. 51) to a torque of 182 N·m (135 ft. lbs.).

(13) Install wheel and tire assembly.

(14) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(15) Remove jack stand from under lower control arm and lower vehicle to the ground.

(16) Check the vehicles alignment specifications and set front Toe to preferred specifications.

## STABILIZER BAR (FRONT)

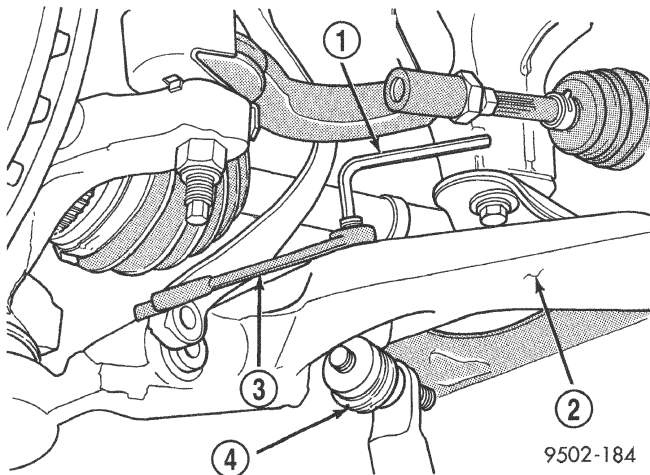
### REMOVAL

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove nuts and stabilizer bar attaching link assemblies from the front lower control arms (Fig. 54). When removing attaching link nut, keep stud from turning by installing an allen wrench in the end of the stud (Fig. 54).



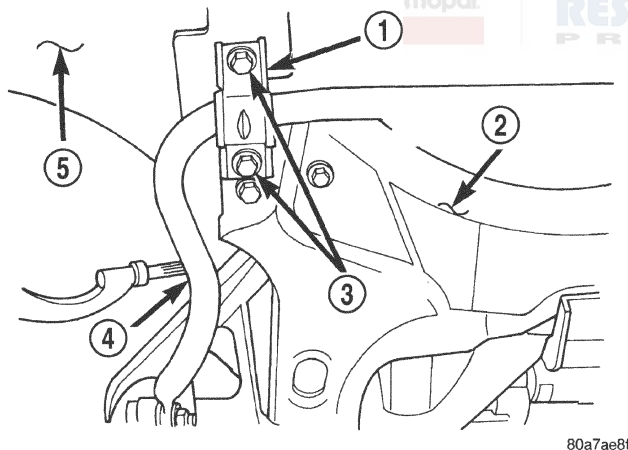
## REMOVAL AND INSTALLATION (Continued)



**Fig. 54 Stabilizer Bar Attaching Link Nut Removal**

- 1 - ALLEN WRENCH
- 2 - LOWER CONTROL ARM
- 3 - WRENCH
- 4 - STABILIZER BAR LINK ASSEMBLY

(3) Remove the 4 bolts attaching the stabilizer bar bushing retainers to the front suspension crossmember and body (Fig. 55). Then remove the stabilizer bar assembly from the vehicle.



**Fig. 55 Stabilizer Bar Bushing Retainer Attaching Bolts**

- 1 - STABILIZER BAR BUSHING CLAMP
- 2 - FRONT SUSPENSION CROSSMEMBER
- 3 - ATTACHING BOLTS
- 4 - STABILIZER BAR
- 5 - VEHICLE BODY

## STABILIZER BAR INSPECTION

Inspect for broken or distorted stabilizer bar bushings, clamps and attaching links. If stabilizer bar to front crossmember bushing replacement is required, bushing can be removed using the stabilizer bar

bushing removal procedure in the Disassembly And Assembly section in this group of the service manual.

If inspection determines that replacement of a stabilizer bar to lower control arm attachment link is required, replace the link before installing stabilizer bar.

## INSTALLATION

(1) Position stabilizer bar and bushings as an assembly into front crossmember. Install the stabilizer bar bushing retainer to crossmember and body attaching bolts (Fig. 55).

(2) Tighten the bushing retainer attaching bolts to a torque of 61 N·m (45 ft. lbs.).

(3) Align stabilizer bar attaching link assemblies with attaching link mounting holes in the lower control arms. Install stabilizer bar attaching links into both lower control arms. Install the attaching link to lower control arm retaining nuts. Torque the stabilizer bar attaching link nuts to 101 N·m (75 ft. lbs.).

## WHEEL MOUNTING STUDS (FRONT)

**CAUTION:** If a wheel mounting stud needs to be replaced in the hub and bearing assembly, **DO NOT** hammer the studs out of the hub flange. If a stud is removed by hammering it out of the bearing flange, damage to the hub and bearing assembly will occur leading to premature bearing failure.

## REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the front wheel and tire assembly from the vehicle.

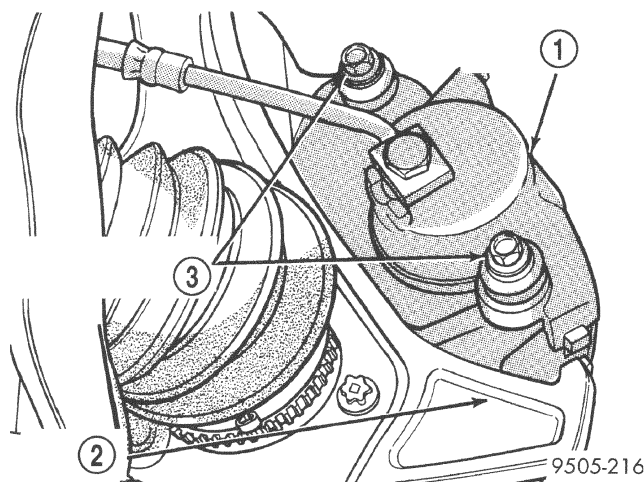
(3) Remove front disc brake caliper to steering knuckle attaching bolts (Fig. 56).

(4) Remove disc brake caliper assembly from steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then removing top of caliper out from under steering knuckle (Fig. 57).

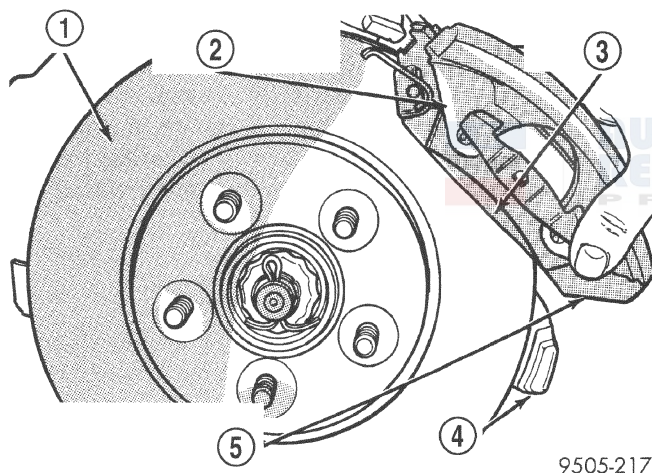
(5) Support brake caliper/adaptor assembly using a wire hook and not by hydraulic hose (Fig. 58).

(6) Remove braking disc from front hub (Fig. 59).

(7) Install a lug nut on wheel stud to be removed from hub and bearing assembly, (Fig. 60) so threads on stud are even with end of lug nut. Rotate hub so stud requiring removal is aligned with notch cast into front of steering knuckle. Install Remover, Special Tool C-4150 on hub and bearing assembly flange and wheel stud (Fig. 60).

**REMOVAL AND INSTALLATION (Continued)****Fig. 56 Brake Caliper Attaching Bolts**

- 1 - DISC BRAKE CALIPER ASSEMBLY
- 2 - STEERING KNUCKLE
- 3 - CALIPER ASSEMBLY GUIDE PIN BOLTS

**Fig. 57 Brake Caliper Assembly Removal And Installation**

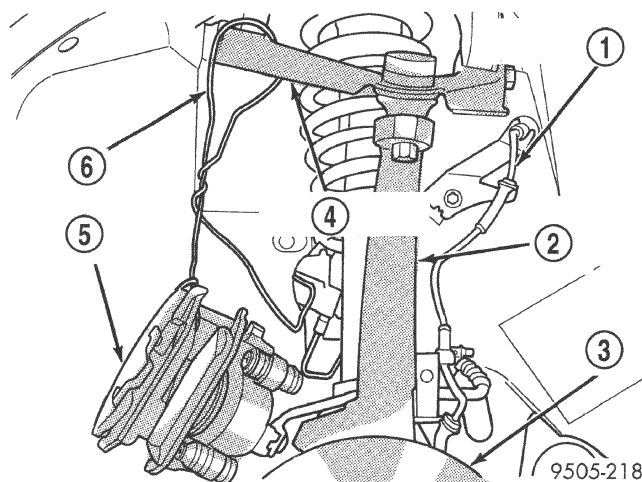
- 1 - ROTOR
- 2 - DISC BRAKE CALIPER ASSEMBLY
- 3 - OUTBOARD BRAKE SHOE
- 4 - STEERING KNUCKLE
- 5 - LIFT THIS END OF CALIPER AWAY FROM STEERING KNUCKLE FIRST

(8) Tighten down on special tool, this will push the wheel stud out of the hub and bearing flange.

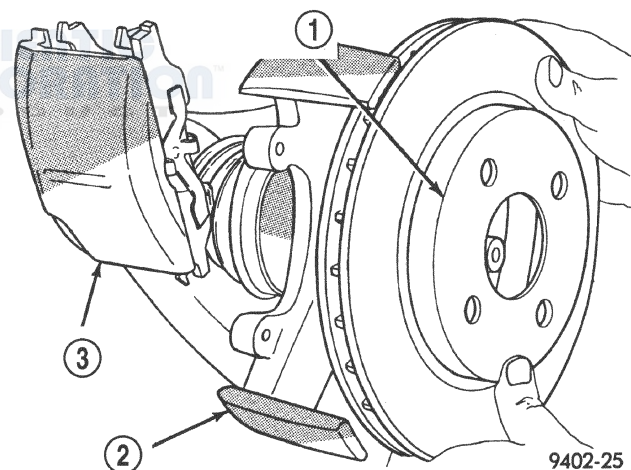
**INSTALLATION**

(1) Install replacement wheel stud into flange of hub and bearing assembly. Install washers on wheel stud, then install a wheel lug nut on stud with flat side of lug nut against washers (Fig. 61).

(2) Tighten the wheel lug nut, pulling the wheel stud into the flange of the hub and bearing assembly.

**Fig. 58 Supporting Brake Caliper**

- 1 - ABS SPEED SENSOR CABLE
- 2 - STEERING KNUCKLE
- 3 - ROTOR
- 4 - UPPER CONTROL ARM
- 5 - DISC BRAKE CALIPER ASSEMBLY
- 6 - WIRE HANGER

**Fig. 59 Removing/Installing Front Braking Disc**

- 1 - BRAKING DISC
- 2 - STEERING KNUCKLE
- 3 - DISC BRAKE CALIPER ASSEMBLY (STORED)

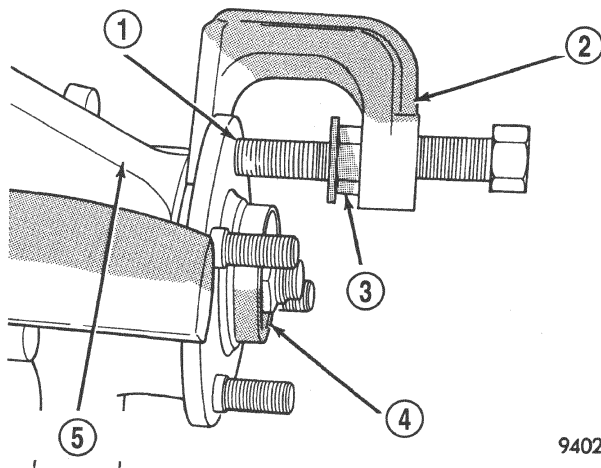
When the head of the stud is fully seated against the bearing flange, remove lug nut and washers from wheel stud.

(3) Install braking disk back on front hub (Fig. 59).

(4) Install disc brake caliper assembly on steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then installing bottom of caliper against bottom abutment of steering knuckle (Fig. 57).

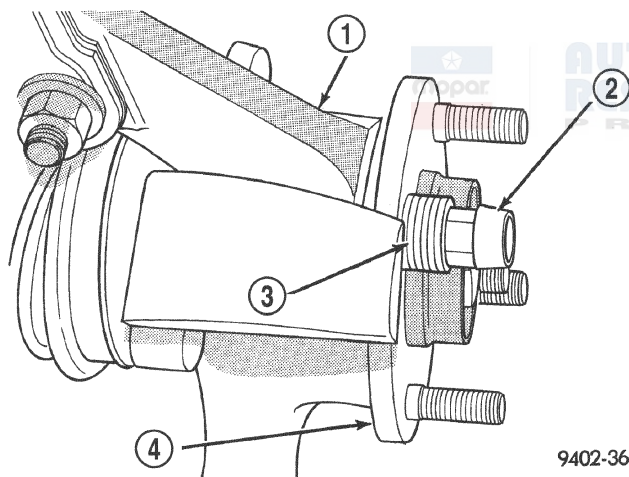


## REMOVAL AND INSTALLATION (Continued)



**Fig. 60 Removing Wheel Stud From Hub And Bearing**

- 1 - WHEEL STUD
- 2 - SPECIAL TOOL C-4150A
- 3 - LUG NUT
- 4 - FRONT HUB
- 5 - STEERING KNUCKLE



**Fig. 61 Installing Wheel Stud Into Hub**

- 1 - STEERING KNUCKLE
- 2 - WHEEL LUG NUT
- 3 - WASHERS
- 4 - FRONT HUB

(5) Install disc brake caliper assembly to steering knuckle attaching bolts (Fig. 56) and torque to 31 N·m (23 ft. lbs.).

(6) Install front wheel and tire assembly. Install front wheel lug nuts and torque to 129 N·m (95 ft.lbs.).

(7) Lower vehicle.

## DISASSEMBLY AND ASSEMBLY

## SHOCK ASSEMBLY (FRONT)

The shock assembly must be removed from the vehicle for it to be disassembled and assembled. Refer to REMOVAL AND INSTALLATION in this section for the required procedure.

For the disassembly and assembly of the shock assembly, use strut spring compressor Pentastar Service Equipment (PSE) tool W-7200, or the equivalent, to compress the coil spring. Follow the manufacturer's instructions closely.

## DISASSEMBLY

(1) If both shocks are being serviced at the same time, mark the coil spring and shock assembly according to which side of the vehicle the shock was removed from, and which shock the coil spring was removed from.

(2) Position the shock assembly in the strut coil spring compressor following the manufacturer's instructions. Set the lower hooks and install the clamp on the lower end of the coil spring, so the shock is held in place once the shock shaft nut is removed (Fig. 62). Rotate the shock assembly so the upper control arm ball joint sits directly below the front upper hook as shown (Fig. 63). Position the upper hooks on top of the upper mounting bracket (Fig. 63).

**WARNING: DO NOT REMOVE THE SHOCK ROD NUT BEFORE THE COIL SPRING IS COMPRESSED. THE COIL SPRING IS HELD UNDER PRESSURE AND MUST BE COMPRESSED, REMOVING SPRING TENSION FROM THE UPPER MOUNTING BRACKET BEFORE THE ROD NUT IS REMOVED.**

(3) Compress the coil spring until all coil spring tension is removed from the upper mounting bracket.

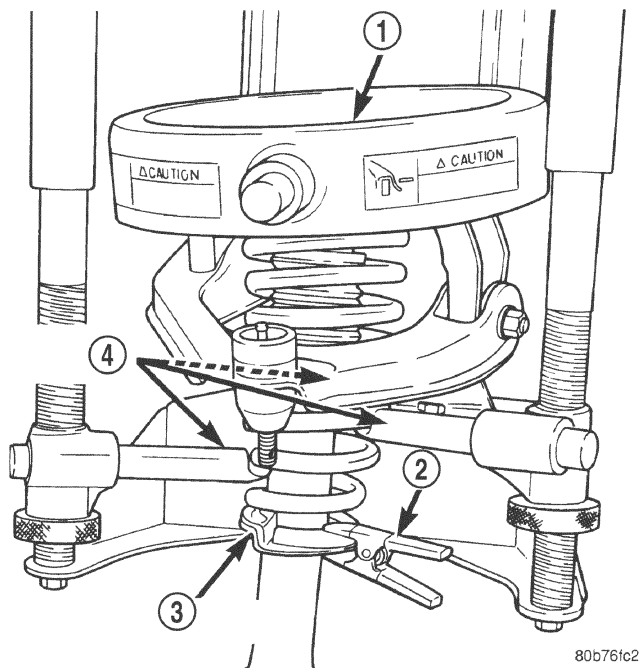
(4) Hold the shock rod from rotating using special socket Snap-On A136, or an equivalent, and remove the retainer nut (Fig. 64).

(5) Remove the upper bushing retainer washer (Fig. 65) from the shock absorber rod.

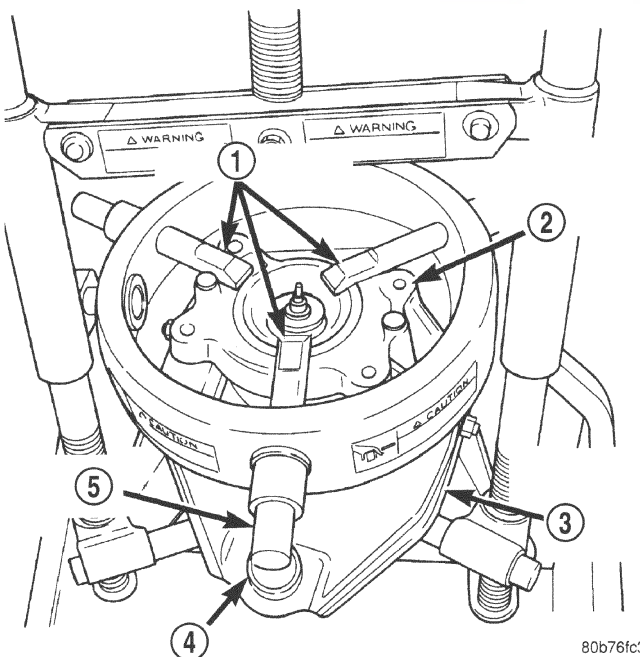
(6) Remove the clamp from the bottom of the coil spring and remove the shock absorber, lower spring isolator, jounce bumper, cup, dust boot, and lower bushing retainer washer out through the bottom of the coil spring.

**NOTE: If the coil spring, upper mounting bracket, rod bushings, upper coil spring isolator, or upper control arm need to be serviced, proceed with the next step, otherwise, proceed with step 11.**

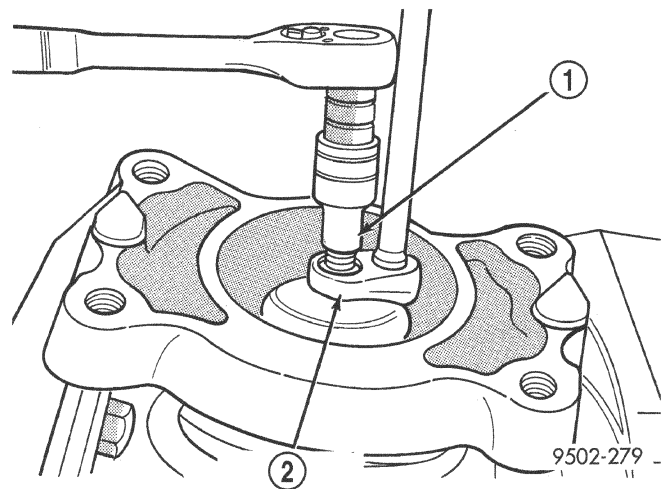


**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 62 Lower Hooks And Clamp**

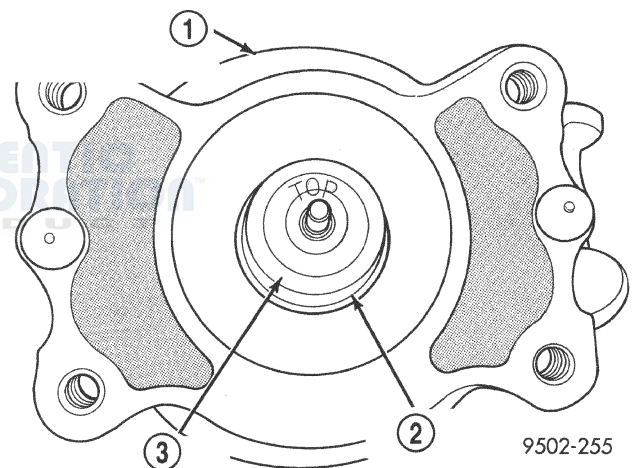
- 1 - COMPRESSOR
- 2 - CLAMP
- 3 - COIL SPRING
- 4 - LOWER HOOKS

**Fig. 63 Upper Hooks Positioned**

- 1 - UPPER HOOKS
- 2 - UPPER MOUNTING BRACKET
- 3 - UPPER CONTROL ARM
- 4 - UPPER BALL JOINT
- 5 - FRONT HOOK

**Fig. 64 Retainer Nut Removal/Installation**

- 1 - SHOCK ABSORBER SOCKET SNAP-ON A136
- 2 - CROW FOOT

**Fig. 65 Washer**

- 1 - SHOCK ABSORBER/UPPER CONTROL ARM MOUNTING BRACKET
- 2 - ISOLATOR BUSHING
- 3 - WASHER

**NOTE:** Before removing the coil spring from the spring compressor, note the position of the lower coil spring end to the spring compressor. The coil spring will need to be in this position on reassembly for proper coil spring-to-shock absorber and upper mounting bracket orientation.

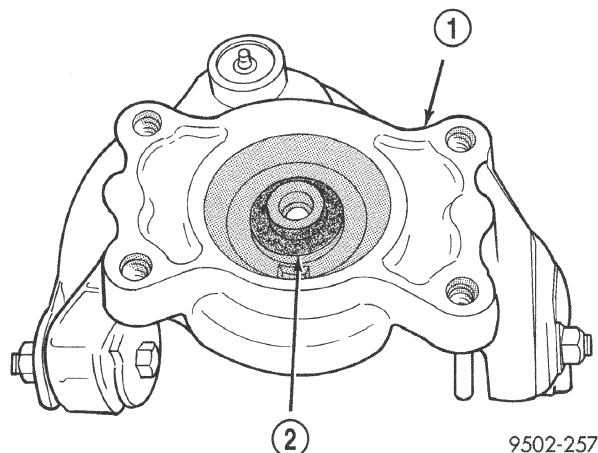
(7) Release the tension from the coil spring by backing off the compressor drive fully. Push back the compressor upper hooks and remove the upper mounting bracket and upper control arm from the coil spring.

(8) Note the position of the coil spring in the spring compressor as listed in the above note before

## DISASSEMBLY AND ASSEMBLY (Continued)

removal. This is necessary for proper alignment of the shock assembly components when reassembly is made. Remove the coil spring from the spring compressor.

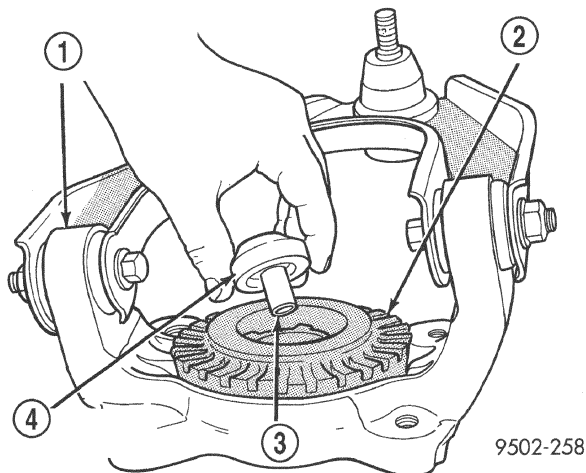
(9) Remove the shock absorber rod upper isolator bushing from the upper (shock absorber/upper control arm) mounting bracket (Fig. 66).



**Fig. 66 Shock Absorber Rod Upper Isolator Bushing**

- 1 - SHOCK ABSORBER/CONTROL ARM MOUNTING BRACKET
- 2 - SHOCK ABSORBER ROD UPPER ISOLATOR BUSHING

(10) Remove the shock absorber rod lower isolator bushing and sleeve from the upper (shock absorber/upper control arm) mounting bracket (Fig. 67). Remove upper coil spring isolator from mounting bracket.



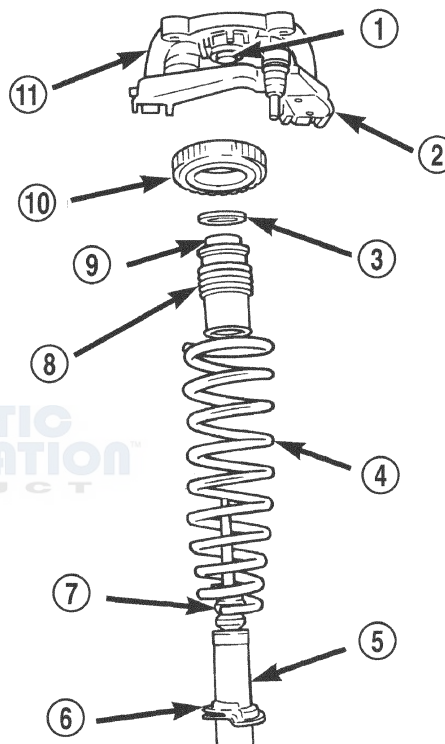
**Fig. 67 Shock Absorber Rod Lower Isolator Bushing**

- 1 - SHOCK ABSORBER/CONTROL ARM MOUNTING BRACKET
- 2 - UPPER SPRING ISOLATOR
- 3 - SLEEVE
- 4 - LOWER ISOLATOR BUSHING

**NOTE:** If removal of the upper control arm is necessary, refer to UPPER CONTROL ARM in the REMOVAL AND INSTALLATION section of this group.

(11) Remove the lower shock rod bushing retainer washer from the shock absorber rod (Fig. 68).

(12) Remove the dust shield and cup as an assembly from the shock absorber rod by pulling both straight up and off the shock rod (Fig. 68). The jounce bumper may come off at the same time. Remove the jounce bumper and metal collar.



**Fig. 68 Shock Assembly Components**

- 1 - SHOCK ABSORBER ROD BUSHING
- 2 - UPPER CONTROL ARM
- 3 - RETAINER WASHER
- 4 - COIL SPRING
- 5 - SHOCK ABSORBER
- 6 - LOWER SPRING ISOLATOR
- 7 - JOUNCE BUMPER
- 8 - DUST SHIELD
- 9 - CUP
- 10 - UPPER SPRING ISOLATOR
- 11 - UPPER MOUNTING BRACKET

(13) Remove the lower spring isolator (Fig. 68) from the lower spring seat on the shock absorber.

(14) Inspect the shock assembly components for the following and replace as necessary:

- Inspect the shock for any condition of rod binding over the full stroke of the shaft.

**DISASSEMBLY AND ASSEMBLY (Continued)**

- Check the upper mounting bracket for cracks, distortion and any sign of damage.
- Inspect the upper mounting bracket-upper control bushings for deterioration of the rubber.
- Check the upper and lower shock rod isolator bushings for severe deterioration of the rubber.
- Check the upper and lower spring isolators for severe deterioration of the rubber.
- Inspect the dust shield for rips and deterioration.
- Inspect the jounce bumper for cracks and signs of deterioration.
- Inspect the coil spring for any sign of damage to the coating.

**ASSEMBLY**

**NOTE:** If the coil spring, upper mounting bracket, rod bushings, upper coil spring isolator, and upper control arm have been removed from the spring compressor, proceed with the next step, otherwise, proceed with step 7.

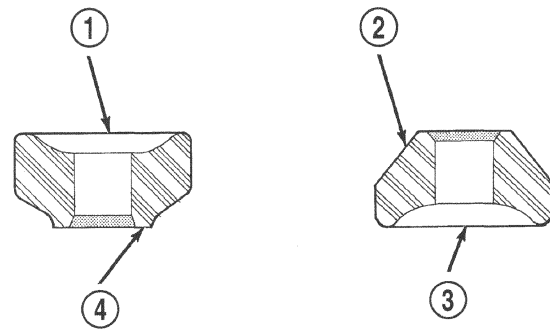
**NOTE:** If installation of the upper control arm on the upper mounting bracket is necessary, refer to UPPER CONTROL ARM in the REMOVAL AND INSTALLATION section of this group to reinstall the upper control arm on the upper mounting bracket before proceeding.

(1) Install the upper coil spring isolator on the upper (shock absorber/upper control arm) mounting bracket (Fig. 67).

**CAUTION:** The top and bottom shock absorber rod isolator bushings are unique to the position which they are installed on the rod. When installing the bushings on the rod, attention must be paid to their location so they are installed correctly (Fig. 69).

(2) Install the sleeve into the lower shock absorber rod isolator bushing (Fig. 67). Install the shock absorber rod lower isolator bushing and sleeve in the bottom of the upper (shock absorber/upper control arm) mounting bracket as shown (Fig. 67). From the top, install the shock absorber rod upper isolator bushing into the center of the upper mounting bracket over the sleeve protruding from the lower isolator bushing (Fig. 66). The smaller end of each bushing is to face away from the upper mounting bracket once installed.

(3) Place the lower end (smaller diameter) of the coil spring in the spring compressor supported by the lower hooks, following the manufacturer's instructions. Position the coil spring lower end tip at the position it was at before coil spring removal from the



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**Fig. 69 Upper And Lower Shock Absorber Rod Bushing Identification**

- 1 - INSTALL ON SHOCK ABSORBER ROD IN THIS DIRECTION
- 2 - SHOCK ABSORBER ROD UPPER ISOLATOR BUSHING
- 3 - INSTALL ON SHOCK ABSORBER ROD IN THIS DIRECTION
- 4 - SHOCK ABSORBER ROD LOWER ISOLATOR BUSHING

compressor as noted in step of DISASSEMBLY. Proper orientation of the spring in the compressor is necessary for proper alignment of all shock assembly components.

(4) Install the upper (shock absorber/upper control arm) mounting bracket on top of the coil spring matching the coil spring to its isolator on the upper mounting bracket. Position the upper control arm ball joint so it lies directly below the front upper hook as shown (Fig. 63).

(5) Position the upper hooks on top of the upper mounting bracket as shown (Fig. 63).

(6) Compress the coil spring.

(7) Install the lower spring isolator on the lower spring seat of the shock absorber (Fig. 68). When installing the spring isolator, be sure the isolator sets in the notch made for the lower coil spring end.

(8) Install the jounce bumper on the shock rod (Fig. 70). Install the jounce bumper with the pointed end pointing downward.

(9) Install the collar, undercut side facing down, on the rod of the shock absorber (Fig. 71). Be sure the collar is positioned squarely on the step of the shock absorber rod.

(10) Install the dust shield and cup (Fig. 68) onto the shock rod until the cup contacts the collar just installed. The dust boot will snap over the jounce bumper. Install the lower shock rod bushing retainer washer.

(11) Install the shock through the bottom of the coil spring until the lower spring seat contacts the lower end of the coil spring. The lower coil spring end should set into the notch of the shock absorber lower seat and isolator. Install the clamp temporarily securing the shock absorber to the coil spring (Fig. 62).



## DISASSEMBLY AND ASSEMBLY (Continued)

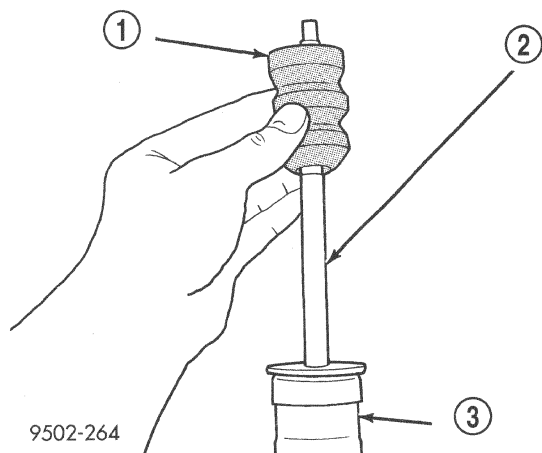


Fig. 70 Jounce Bumper Installation

- 1 - JOUNCE BUMPER
- 2 - SHOCK ABSORBER ROD
- 3 - SHOCK ABSORBER

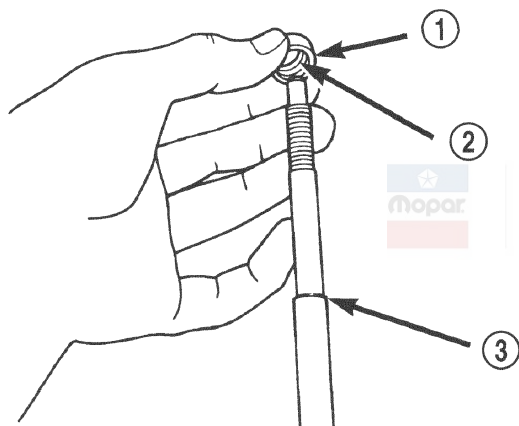


Fig. 71 Shock Absorber Rod Collar Installation

- 1 - COLLAR
- 2 - UNDERCUT
- 3 - SHOCK ABSORBER ROD STEP

(12) Install the upper shock rod bushing retainer washer. Make sure the concave side is facing up.

(13) Install the shock assembly retainer nut. Hold the shock rod from rotating using special socket Snap-On A136, or an equivalent, and tighten the retainer nut using a crow foot wrench (on the end of a torque wrench and extension) to a torque of 55 N·m (40 ft. lbs.) (Fig. 64).

(14) Slowly release the tension from the coil spring by backing off the compressor drive fully. As the tension is relieved, make sure the upper mounting bracket, isolator, and coil spring align properly. Remove the clamp from the lower end of the coil spring and shock. Push back the spring compressor upper and lower hooks, then remove the shock assembly from the spring compressor.

(15) Install shock assembly on the vehicle. Refer to REMOVAL AND INSTALLATION in this section for the required procedure.

## BALL JOINT SEAL BOOT (FRONT UPPER)

(1) Using a screw driver or other suitable tool, pry seal boot off of the ball joint assembly (Fig. 72).

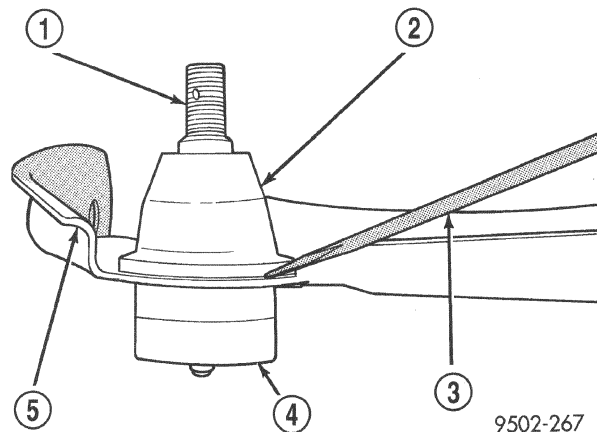


Fig. 72 Seal Boot Removal From Ball Joint

- 1 - BALL JOINT STUD
- 2 - BALL JOINT SEAL BOOT
- 3 - SCREWDRIVER
- 4 - BALL JOINT
- 5 - CONTROL ARM

(2) Install a **NEW** ball joint assembly sealing boot on ball joint assembly. Install sealing boot as far as possible on ball joint assembly.

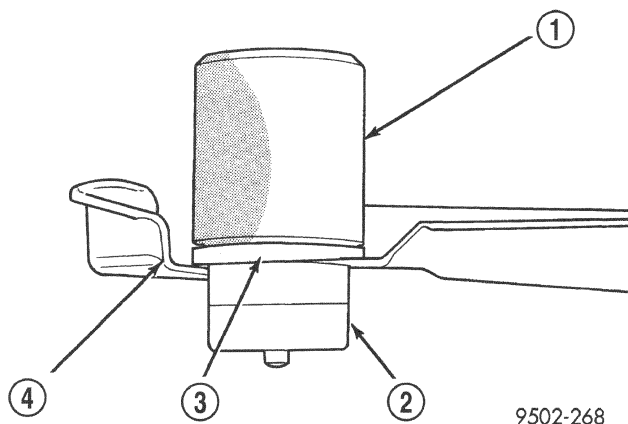
**CAUTION:** Do not use an arbor press to install the sealing boot on the upper control arm ball joint assembly. Damage to the sealing boot can occur due to excessive pressure applied to sealing boot when being installed.

(3) Position Receiving Cup, Special Tool 6758 over sealing boot so it is aligned properly with bottom edge of sealing boot (Fig. 73). Apply pressure **BY HAND** to special tool 6758, until sealing boot is pressed squarely against surface of upper control arm.

(4) Properly lubricate the upper ball joint assembly using only Mopar Multi-Mileage Lube or an equivalent.

## BALL JOINT SEAL BOOT (LOWER)

**CAUTION:** The replacement of the lower ball joint seal boot can only be done in the event that the seal boot is damaged while performing a service procedure on the vehicle.

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 73 Seal Boot Installation On Ball Joint**

- 1 - SPECIAL TOOL 6758
- 2 - BALL JOINT
- 3 - SEAL BOOT
- 4 - CONTROL ARM

**CAUTION:** Under no circumstances can a lower ball joint seal boot be replaced if it is determined that the vehicle had been driven with the seal boot damaged. If the vehicle has been driven with a damaged seal boot contamination of the ball joint has occurred. When contamination of the ball joint has occurred the lower control arm must be replaced. This is to ensure excessive wear of the ball joint does not occur from the contamination present in the ball joint.

**CAUTION:** Excessive wear in the ball joint can lead to a separation of the ball joint from the lower control arm.

**CAUTION:** The procedure below must be carefully followed when replacing the ball joint seal in the event it is damaged while servicing a vehicle.

**CAUTION:** The ball joint used in the lower control arm of this vehicle is a lubricated for life ball joint. This ball joint does not require any additional lubrication for the life of the vehicle. Do not alter the lower control arm or ball joint in an attempt to lubricate the lower control arm ball joint. If it is determined that the ball joint is lacking proper lubrication, the lower control arm will need to be replaced.

**DISASSEMBLE**

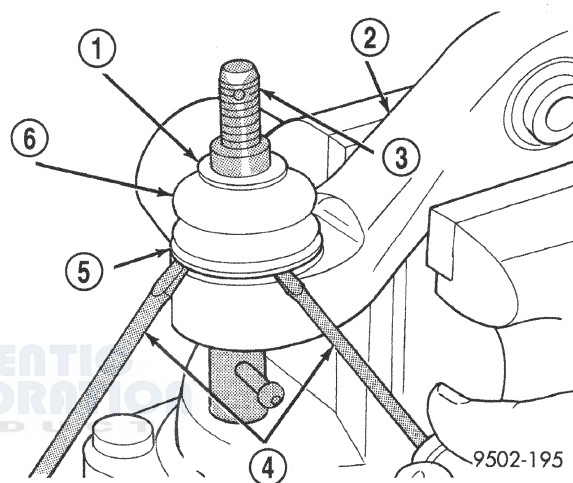
(1) Remove lower control arm assembly from vehicle. See Lower Control Arm Removal in this section

of the service manual for the required removal procedure.

(2) Wrap a shop towel around the ball joint and seal boot. This is to prevent dirt and cleaning solvent to enter ball joint when cleaning area around ball joint.

(3) Using **ONLY** a solvent such as Mopar Foamy Engine Degreaser or an equivalent, thoroughly clean lower control arm in area around ball joint and seal. Then using a shop towel saturated with the engine degreaser, carefully wipe off the ball joint seal boot.

(4) Using 2 screwdrivers (Fig. 74) remove the ball joint seal retaining ring from the bottom of the ball joint seal.

**Fig. 74 Removing Ball Joint Seal Retaining Ring**

- 1 - UPPER SEALING RING
- 2 - LOWER CONTROL ARM
- 3 - BALL JOINT
- 4 - SCREWDRIVERS
- 5 - BALL JOINT SEAL RETAINING RING
- 6 - BALL JOINT SEAL

(5) Remove ball joint seal from ball joint.

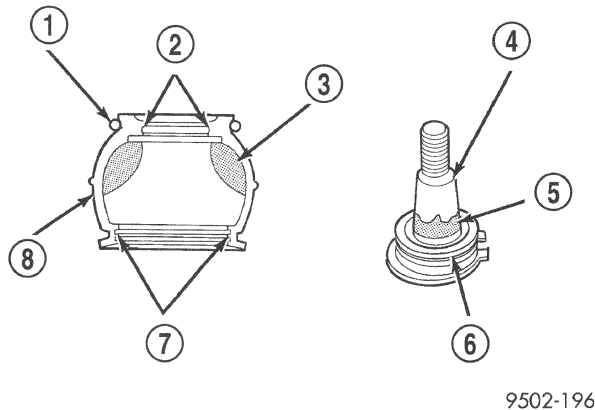
**ASSEMBLE**

**CAUTION:** When replacing ball joint seal, do not use any other type of grease to lubricate ball joint other than the lubricant provided in the Mopar Ball Joint Seal service kit.

(1) Apply grease from the ball joint seal kit, to the specified areas of the ball joint stud and seal (Fig. 75). Be sure no grease is present on the seal boot installation section of the seal boot or lower control arm (Fig. 75).

(2) Slide ball joint seal boot with upper seal ring installed, (Fig. 75) down tapered section of ball joint stud (Fig. 75). Seal boot is to be installed on stud of

## DISASSEMBLY AND ASSEMBLY (Continued)



**Fig. 75 Grease Correctly Applied To Ball Joint Stud And Seal Boot**

- 1 - UPPER SEALING RING
- 2 - LIP
- 3 - GREASE
- 4 - BALL JOINT STUD TAPERED SECTION
- 5 - GREASE
- 6 - BOOT INSTALLATION SECTION  
Wipe off the grease.
- 7 - BOOT INSTALLATION SECTION  
Wipe off the grease.
- 8 - BALL JOINT SEAL BOOT

ball joint until seal boot is sitting on seal groove in lower control arm.

(3) Carefully position ball joint seal boot in seal retaining groove on lower control arm. After installing seal boot in retaining groove, carefully bleed air out of sealing boot without getting grease pushed into seal boot retaining groove in lower control arm.

(4) Place Retaining Ring Installer, Special Tool, 6875-1 over ball joint seal boot (Fig. 76). Using adjusting knob, adjust tool so bottom edge of tool is even with top of retaining ring groove in seal boot (Fig. 76).

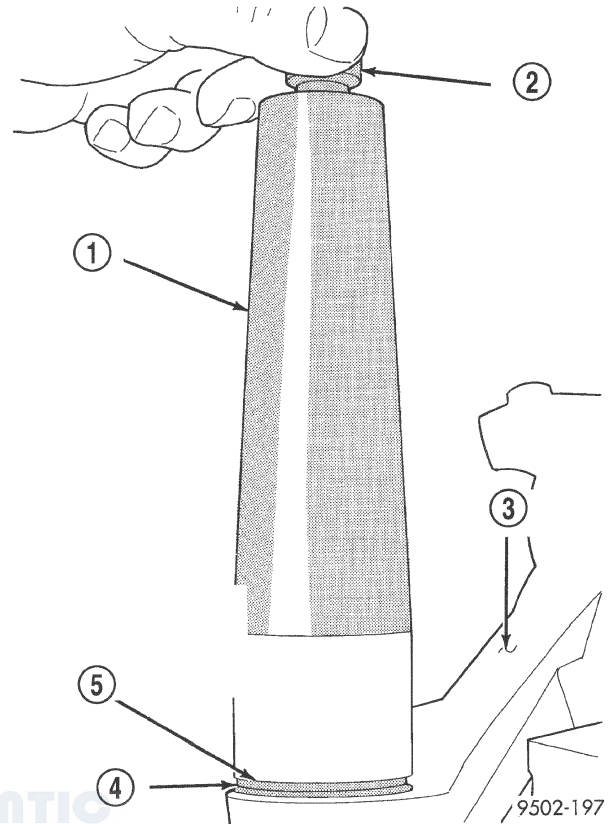
(5) Place seal boot retaining ring on Installer, Special Tool, 6875-1 (Fig. 77). Then place expandable collar from Installer, Special Tool, 6875 over tapered cone of the special tool (Fig. 77).

(6) Using the expandable collar of Installer, Special Tool, 6875 (Fig. 78) push the seal boot retaining ring down the cone of Installer, Special Tool, 6875.

(7) Continue pushing retaining ring down Installer, Special Tool, 6875, until it is installed in the retaining ring groove of the seal boot (Fig. 79)

(8) Remove Installer, Special Tool, 6875 from the ball joint seal boot. **When removing tool from seal boot be careful not to damage the seal boot with the tool.**

(9) Check retaining ring installation on seal boot to ensure it is fully seated in seal boot groove and the ends are not twisted (Fig. 80). Also, make sure upper sealing ring is on seal boot and correctly



**Fig. 76 Correctly Installed Ball Joint Seal Retaining Ring Tool**

- 1 - SPECIAL TOOL 6875-1
- 2 - ADJUSTING KNOB
- 3 - LOWER CONTROL ARM
- 4 - SEAL BOOT RETAINING RING GROOVE
- 5 - BOTTOM EDGE OF TOOL MUST BE EVEN WITH TOP OF RETAINING RING GROOVE IN SEAL BOOT AS SHOWN

installed (Fig. 80). Check seal boot for damage before installing back on car.

(10) Install lower control arm assembly back on vehicle. See Lower Control Arm Installation in this section of the service manual for the required installation procedure.

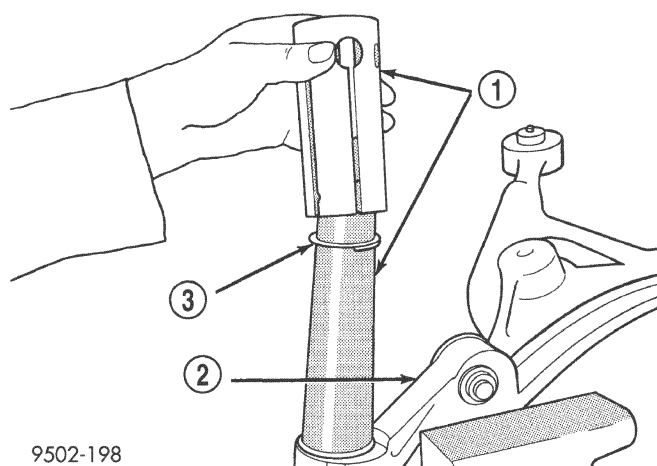
## LOWER CONTROL ARM FRONT ISOLATOR BUSHING

To perform removal and replacement of the lower control arm isolator bushings, the lower control arm must be removed from the vehicle.

## DISASSEMBLY

(1) Remove lower control arm assembly from vehicle. See Lower Control Arm Removal in this section of the service manual for the required removal procedure.

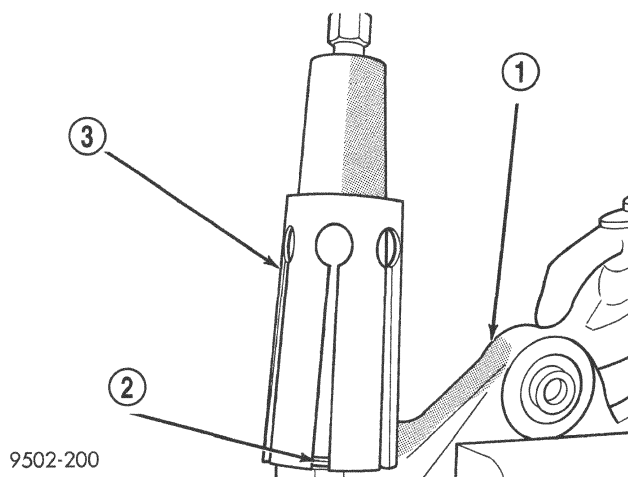


**DISASSEMBLY AND ASSEMBLY (Continued)**

9502-198

**Fig. 77 Retaining Ring And Expandable Collar Installed On Tool**

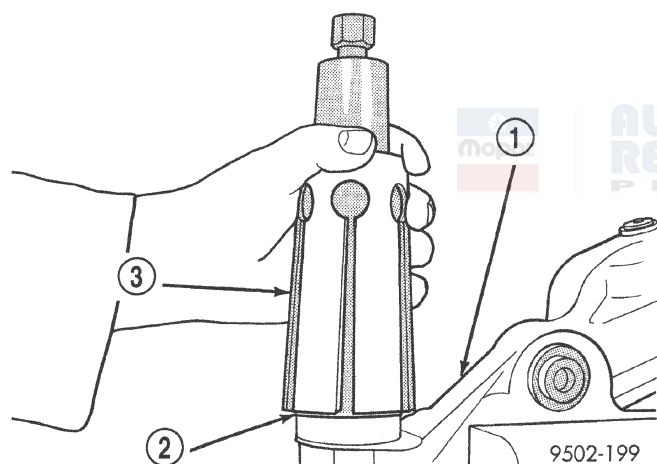
- 1 - SPECIAL TOOL 6875
- 2 - LOWER CONTROL ARM
- 3 - SEAL BOOT RETAINING RING



9502-200

**Fig. 79 Retaining Ring Installed In Ball Joint Seal Boot**

- 1 - LOWER CONTROL ARM
- 2 - SEAL BOOT RETAINING RING
- 3 - SPECIAL TOOL 6875



9502-199

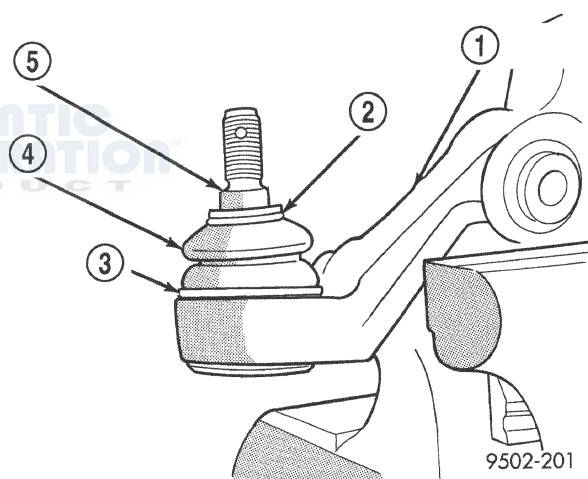
**Fig. 78 Installing Seal Boot Retaining Ring**

- 1 - LOWER CONTROL ARM
- 2 - RETAINING RING
- 3 - SPECIAL TOOL 6875

(2) Install Bushing Remover, Special Tool 6602-5 and Bushing Receiver, Special Tool MB-990799 on Special Tool C-4212-F.

(3) Install lower control arm on Special Tools assembled for removal of the front isolator bushing. Be sure Special Tool MB-990799 is square on lower control arm and Special Tool 6602-5 is positioned correctly on isolator bushing (Fig. 81).

(4) Tighten screw on Remover/Installer Special Tool C-4212-F to press front bushing out of lower control arm.



9502-201

**Fig. 80 Properly Installed Ball Joint Seal Boot**

- 1 - LOWER CONTROL ARM
- 2 - UPPER SEALING RING
- 3 - SEAL BOOT RETAINING RING
- 4 - SEAL BOOT
- 5 - BALL JOINT STUD

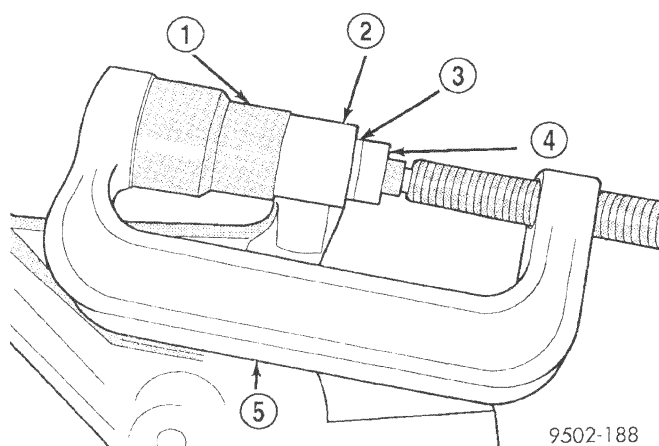
**ASSEMBLY**

(1) Mount Bushing Installer, Special Tool 6876 on screw portion of Remover/Installer Special Tool C-4212-F (Fig. 82).

(2) Start front bushing into lower control arm **by hand, making sure it is square with its mounting hole in the lower control arm**. Bushing is to be installed in lower control arm from the machined surface side of lower control arm bushing hole.

(3) Install lower control arm on Special Tools assembled for installation of front isolator bushing

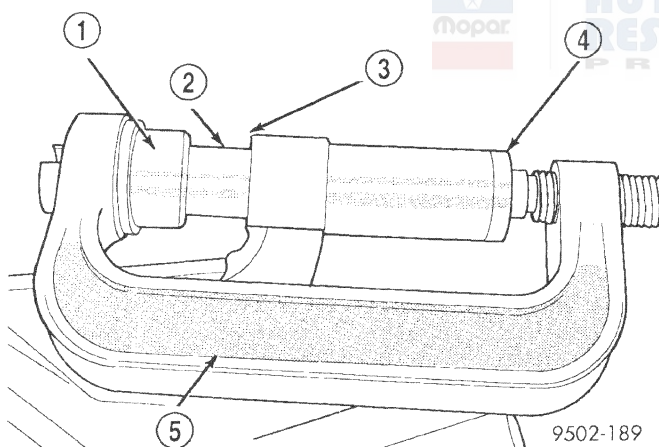
## DISASSEMBLY AND ASSEMBLY (Continued)



**Fig. 81 Removing Front Bushing From Lower Control Arm**

- 1 - SPECIAL TOOL MB-990799
- 2 - LOWER CONTROL ARM
- 3 - FRONT ISOLATOR BUSHING
- 4 - SPECIAL TOOL 6602-5
- 5 - SPECIAL TOOL C-4212-F

into lower control arm (Fig. 82). Be sure Special Tool 6758 is square on lower control arm and Special Tool 6876 is positioned correctly on isolator bushing.



**Fig. 82 Installing Front Bushing In Lower Control Arm**

- 1 - SPECIAL TOOL 6876
- 2 - ISOLATOR BUSHING
- 3 - MACHINED SURFACE SIDE OF LOWER CONTROL ARM
- 4 - SPECIAL TOOL 6758
- 5 - SPECIAL TOOL C-4212-F

(4) Tighten screw on Remover/Installer Special Tool C-4212-F pressing front bushing into lower control arm. Continue pressing front bushing into lower control arm until bushing is sitting flush on the machined surface of the lower control arm. This will correctly position front bushing in lower control arm.

(5) Install lower control arm assembly back on vehicle. See Lower Control Arm Installation in this section of the service manual for the required installation procedure.

## LOWER CONTROL ARM REAR ISOLATOR BUSHING

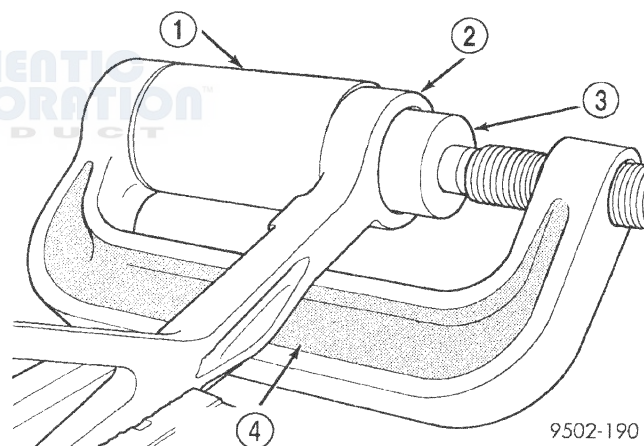
To perform removal and replacement of the lower control arm isolator bushings, the lower control arm must be removed from the vehicle.

### DISASSEMBLY

(1) Remove lower control arm assembly from vehicle. See Lower Control Arm Removal in this section of the service manual for the required removal procedure.

(2) Install Bushing Remover, Special Tool C-4366-2 and Bushing Receiver, Special Tool 6756 on Special Tool C-4212-F (Fig. 83).

(3) Install Special Tools assembled for removal of the rear isolator bushing on the lower control arm. Be sure Special Tool 6756 is square on lower control arm and Special Tool C-4366-2 is positioned correctly on isolator bushing (Fig. 83).



**Fig. 83 Removing Lower Control Arm Rear Bushing**

- 1 - SPECIAL TOOL 6756
- 2 - LOWER CONTROL ARM
- 3 - SPECIAL TOOL C-4366-2
- 4 - SPECIAL TOOL C-4212-F

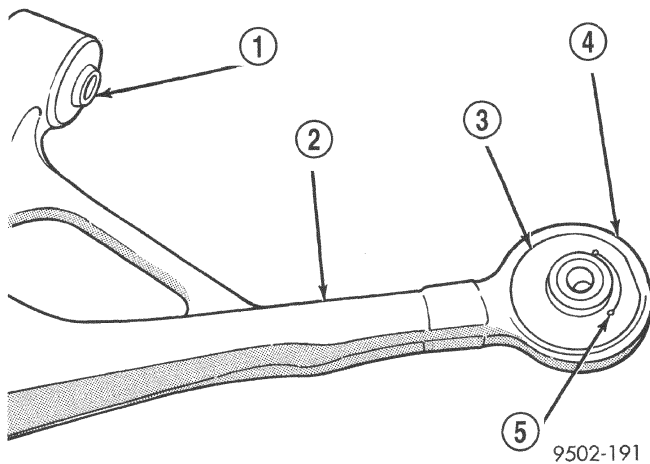
(4) Tighten screw on Remover/Installer Special Tool C-4212-F to press rear bushing out of lower control arm.

### ASSEMBLY

(1) Start rear bushing into lower control arm by hand, making sure it is square with its mounting hole in the lower control arm. Bushing is to be installed from the machined surface side of lower control arm bushing hole, with the void in rubber

**DISASSEMBLY AND ASSEMBLY (Continued)**

portion of bushing facing away from ball joint (Fig. 84).



**Fig. 84 Correctly Positioned Rear Isolator Bushing In Control Arm**

- 1 - FRONT ISOLATOR BUSHING
- 2 - LOWER CONTROL ARM
- 3 - REAR ISOLATOR BUSHING
- 4 - MACHINED SURFACE
- 5 - VOID IN BUSHING IN THIS DIRECTION

(2) Mount Bushing Installer, Special Tool 6760 on screw portion of Remover/Installer Special Tool C-4212-F (Fig. 85).

(3) Install Special Tools assembled for installation of rear isolator bushing into lower control arm on the lower control arm. Be sure Special Tool 6756 is square on lower control arm and Special Tool 6760 is positioned correctly on isolator bushing (Fig. 85).

(4) Tighten screw on Remover/Installer Special Tool C-4212-F pressing rear bushing into lower control arm. Continue pressing rear bushing into lower control arm until bushing is sitting flush on the machined surface (Fig. 85) of the lower control arm. This will correctly position rear bushing in lower control arm.

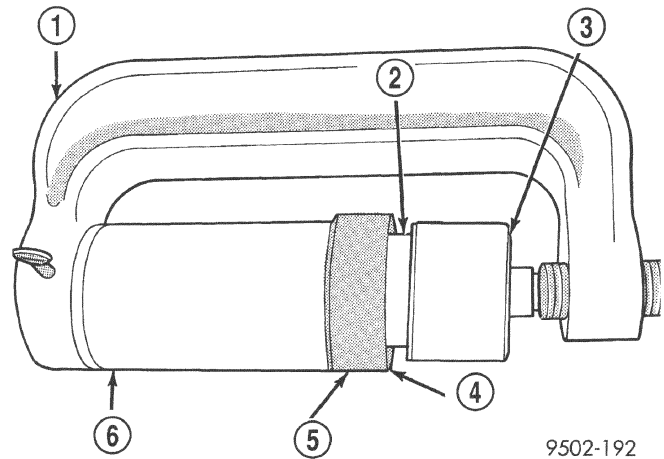
(5) Install lower control arm assembly back on vehicle. See Lower Control Arm Installation in this section of the service manual for the required installation procedure.

**CONTROL ARM CLEVIS BUSHING**

To perform removal and replacement of the lower control arm clevis bushing, the lower control arm must be removed from the vehicle.

**DISASSEMBLE**

(1) Remove lower control arm assembly from vehicle. See Lower Control Arm Removal in this section of the service manual for the required removal procedure.

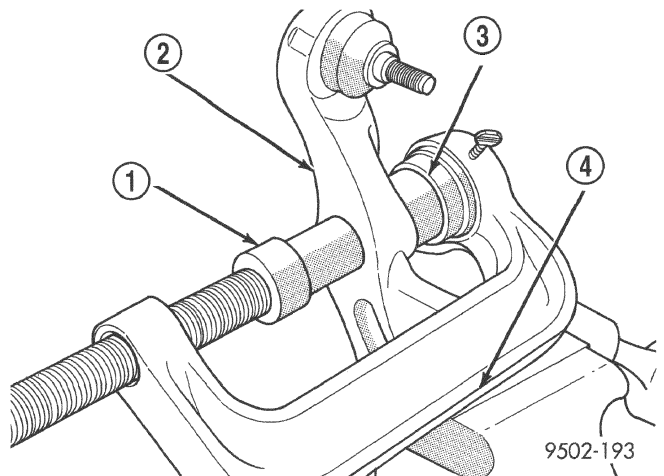


**Fig. 85 Installing Rear Bushing In Lower Control Arm**

- 1 - SPECIAL TOOL C-4212-F
- 2 - REAR BUSHING
- 3 - SPECIAL TOOL 6760
- 4 - MACHINED SURFACE ON LOWER CONTROL ARM
- 5 - LOWER CONTROL ARM
- 6 - SPECIAL TOOL 6756

(2) Install Bushing Remover, Special Tool 6877 and Bushing Receiver, Special Tool 6876 on Special Tool C-4212-F.

(3) Install lower control arm on Special Tools assembled for removal of the clevis isolator bushing. Be sure Special Tool 6876 is square on lower control arm and Special Tool 6877 is positioned correctly on clevis bushing (Fig. 86).



**Fig. 86 Removing Clevis Bushing From Lower Control Arm**

- 1 - SPECIAL TOOL 6877
- 2 - LOWER CONTROL ARM
- 3 - SPECIAL TOOL 6876
- 4 - SPECIAL TOOL C-4212-F



**DISASSEMBLY AND ASSEMBLY (Continued)**

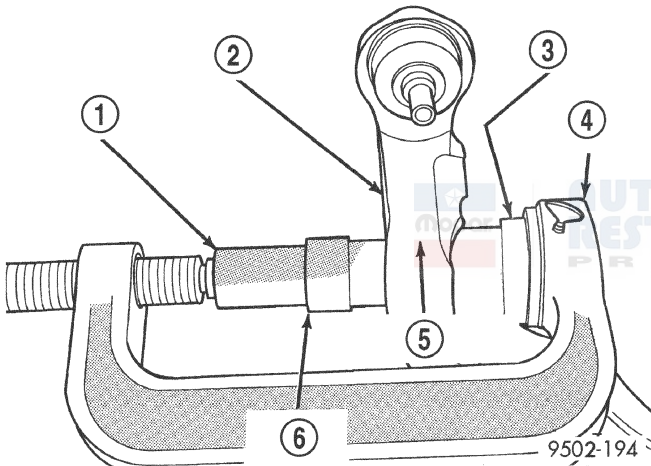
(4) Tighten screw on Remover/Installer Special Tool C-4212-F to press clevis bushing out of lower control arm.

**ASSEMBLE**

(1) Start clevis bushing into lower control arm **by hand, making sure it is square with its mounting hole in the lower control arm.** Bushing is to be installed in lower control arm from the machined surface side of lower control arm bushing hole.

(2) Mount Bushing Installer, Special Tool 6877 on screw portion of Remover/Installer Special Tool C-4212-F as shown in (Fig. 87).

(3) Install the assembled special tools for installing the clevis bushing into the lower control arm, on the lower control arm and clevis bushing (Fig. 87). Be sure Special Tool 6876 is square on lower control arm and Special Tool 6877 is positioned correctly on clevis bushing (Fig. 87).



**Fig. 87 Installing Clevis Bushing In Lower Control Arm**

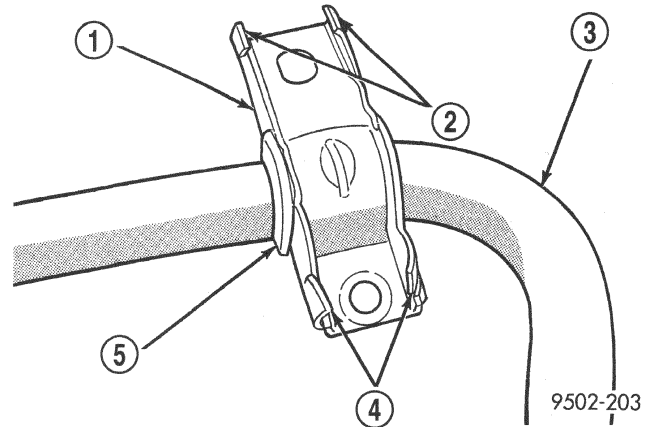
- 1 - SPECIAL TOOL 6877
- 2 - MACHINED SURFACE SIDE OF LOWER CONTROL ARM
- 3 - SPECIAL TOOL 6876
- 4 - SPECIAL TOOL C-4212-F
- 5 - LOWER CONTROL ARM
- 6 - CLEVIS BUSHING

(4) Tighten screw on Remover/Installer Special Tool C-4212-F pressing clevis bushing into lower control arm. Continue pressing clevis bushing into lower control arm until bushing is sitting flush with the machined surface of the lower control arm. This will correctly position the clevis bushing in the lower control arm.

(5) Install lower control arm assembly back on vehicle. See Lower Control Arm Installation in this section of the service manual for the required installation procedure.

**STABILIZER BAR BUSHING (FRONT)**

(1) Bend back the 4 crimp locations on the stabilizer bar bushing retainer (Fig. 88).



**Fig. 88 Stabilizer Bar Bushing Retainer**

- 1 - STABILIZER BAR BUSHING RETAINER
- 2 - CRIMPS
- 3 - STABILIZER BAR
- 4 - CRIMPS
- 5 - STABILIZER BAR BUSHING

(2) Separate the stabilizer bar bushing retainer.

(3) Stabilizer bar bushings are removed by opening slit and peeling bushing off stabilizer bar.

(4) Install new stabilizer bar bushings on the stabilizer bar. **Bushings must be installed on sway bar with slit in bushing facing front of vehicle when sway bar is installed.**

(5) Install bushing retainers back on stabilizer bar bushings.

**SPECIFICATIONS****FRONT SUSPENSION FASTENER TORQUE SPECIFICATIONS**

DESCRIPTION	TORQUE
<b>Shock Assembly</b>	
Clevis Pinch Bolt . . . . .	88 N·m (65 ft. lbs.)
Shock Tower Bolts . . . . .	101 N·m (75 ft. lbs.)
Clevis To Control Arm Bolt . .	88 N·m (65 ft. lbs.)
Rod To Upper Mount Nut . . .	54 N·m (40 ft. lbs.)
<b>Steering Knuckle</b>	
Disc Brake Caliper Bolts . . .	22 N·m (16 ft. lbs.)
Tie Rod Nut . . . . .	61 N·m (45 ft. lbs.)
Tie Rod Adjustment Jam Nuts . . . . .	61 N·m (45 ft. lbs.)

**SPECIFICATIONS (Continued)****DESCRIPTION****TORQUE****Hub And Bearing**

To Stub Axle Retaining Nut . . . . . 244 N·m  
(180 ft. lbs.)

Wheel Stud Lug Nut . . . . . 109-150 N·m  
(80-110 ft. lbs.)

**Upper Control Arm**

Ball Joint Stud Castle Nut . . 54 N·m (40 ft. lbs.)

Shock Bracket . . . . . 90 N·m (66 ft. lbs.)

**Lower Control Arm**

Ball Joint Stud Castle Nut . . 74 N·m (55 ft. lbs.)

Crossmember Pivot Bolt (Front) . . . . . 183 N·m  
(135 ft. lbs.)

Crossmember Rear Bolt . . . . 95 N·m (70 ft. lbs.)

Ball Joint Heat Shield Attaching Bolts . . 13 N·m  
(10 ft. lbs.)

**Stabilizer Bar**

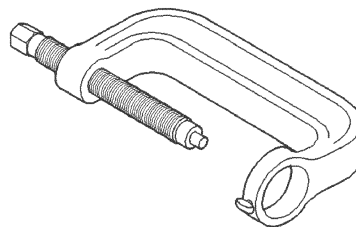
Bushing Clamp Bolts . . . . . 61 N·m (45 ft. lbs.)

Attaching Link Nuts (All) . . 101 N·m (75 ft. lbs.)

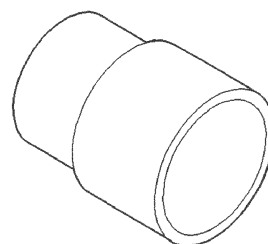
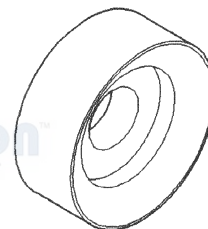
**Front Suspension Crossmember**

Body Mounting Bolts . . . . . 108 N·m (80 ft. lbs.)

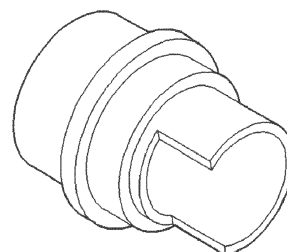
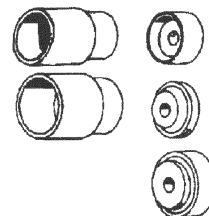
Steering Gear Mounting Bolts . . . . . 68 N·m  
(50 ft. lbs.)



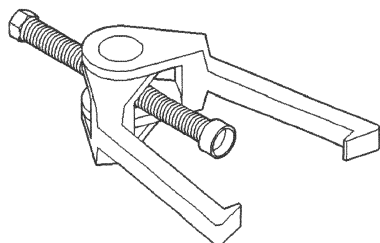
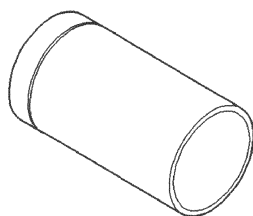
C-4212F-8011d4af

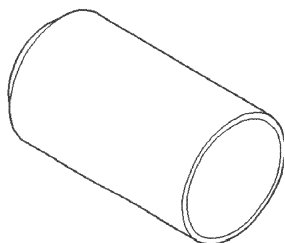
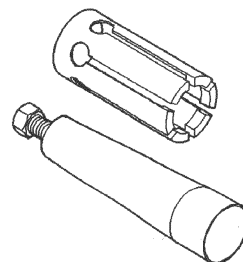
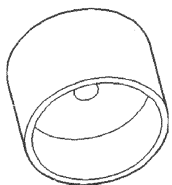
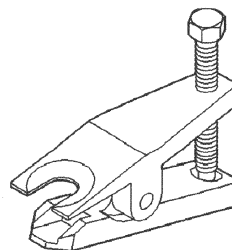
**Press, Ball Joint Remover Installer C-4212F****Remover, Ball Joint MB-990799**

6602-5

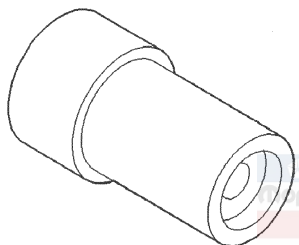
**Remover/Installer Control Arm Bushing 6602-5 (In Tool Kit 6602)****Installer/Receiver, Control Arm Bushing 6876****Remover / Installer C-4366-2 (In Tool Kit C-4366)****SPECIAL TOOLS****FRONT SUSPENSION**

**AUTHENTIC  
RESTORATION  
PRODUCT**

**Puller C-3894-A****Installer, Ball Joint 6758**

**SPECIAL TOOLS (Continued)*****Receiver, Ball Joint 6756******Installer, Ball Joint Seal Boot Retainer 6875******Installer, Bushing 6760***

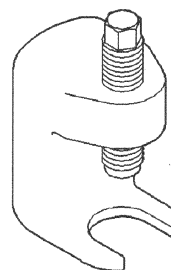
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***Remover, Tie Rod End MB-991113 or MB-990635***

6877

***Remover/Installer Control Arm Clevis Bushing 6877***

**AUTHENTIC  
RESTORATION<sup>™</sup>  
PRODUCT**

***Remover, Lower Ball Joint C-4150A***



## REAR SUSPENSION

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### DESCRIPTION AND OPERATION

#### REAR SUSPENSION SYSTEM

##### DESCRIPTION

The rear suspension used on this vehicle is a fully independent short and long arm style suspension (Fig. 1).

Each side of the rear suspension consists of these major components:

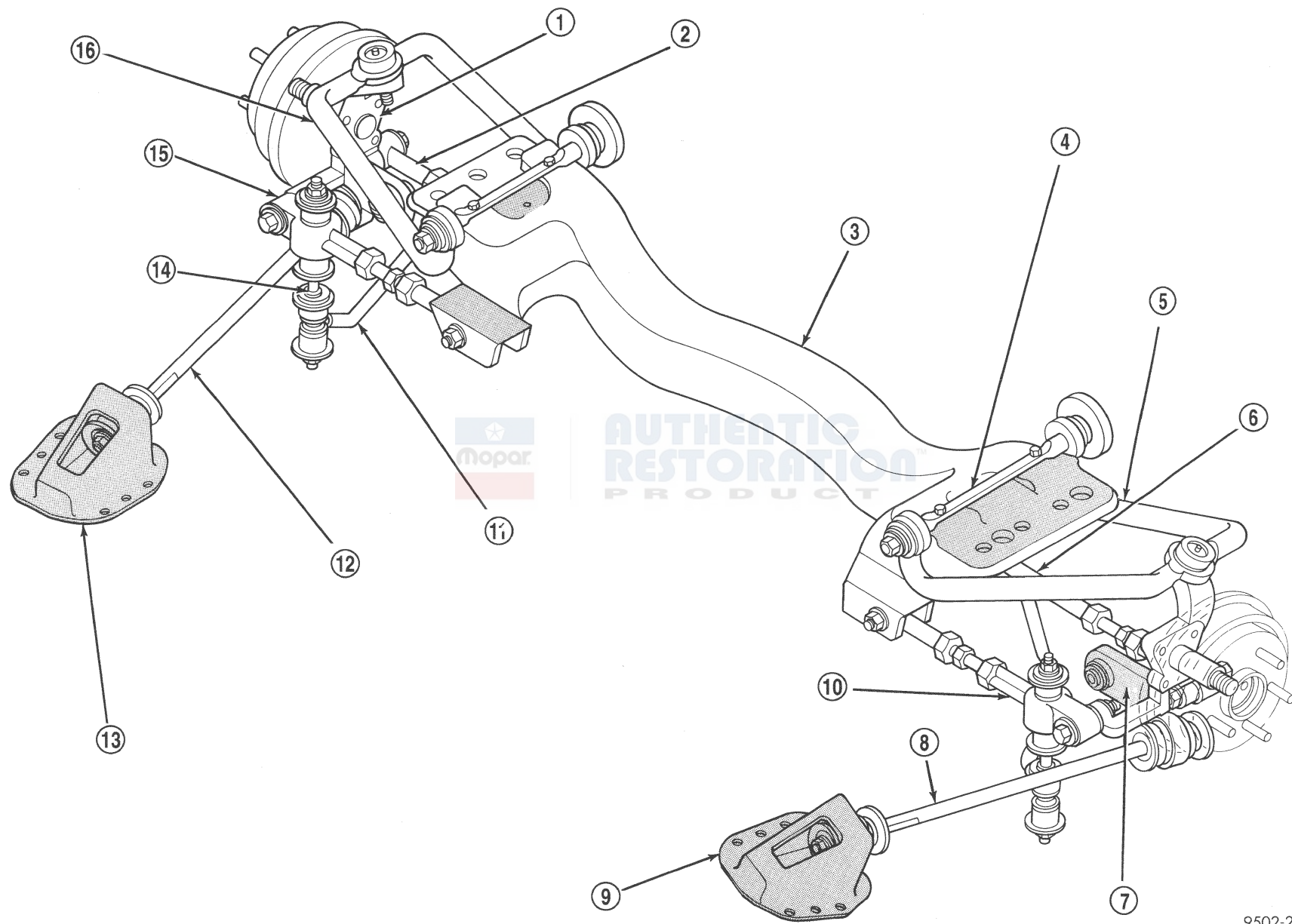
- a shock assembly
- a knuckle

- an upper control arm
- two lateral links
- a trailing link
- a stabilizer bar

##### OPERATION

The rear suspension allows each rear wheel on vehicle to adapt to different road surfaces and conditions without affecting the control of the vehicle. Each side of the suspension is allowed to move independently from the other.

## DESCRIPTION AND OPERATION (Continued)



9502-270

**Fig. 1 Fully Independent Rear Suspension**

**DESCRIPTION AND OPERATION (Continued)**

- |                                 |                                    |
|---------------------------------|------------------------------------|
| 1 – KNUCKLE                     | 9 – TRAILING LINK BRACKET          |
| 2 – REAR LATERAL LINK           | 10 – FORWARD LATERAL LINK          |
| 3 – REAR SUSPENSION CROSSMEMBER | 11 – STABILIZER BAR                |
| 4 – UPPER CONTROL ARM PIVOT BAR | 12 – TRAILING LINK                 |
| 5 – UPPER CONTROL ARM           | 13 – TRAILING LINK BRACKET         |
| 6 – REAR LATERAL LINK           | 14 – STABILIZER BAR ATTACHING LINK |
| 7 – REAR KNUCKLE                | 15 – FORWARD LATERAL ARM           |
| 8 – TRAILING LINK               | 16 – UPPER CONTROL ARM             |
- 

**SHOCK ASSEMBLY (REAR)****DESCRIPTION**

The rear shock absorber assemblies support the weight of the vehicle using coil springs positioned around the shock absorbers. The coil springs are contained between the upper mount of the shock absorber and a lower spring seat on the body of the shock absorber.

The top of each shock absorber assembly is bolted to the top of the inner fender through a rubber isolated mount.

The bottom of the shock absorber assembly attaches to the rear knuckle using a through-bolt.

The rear coil springs are rated separately for each corner or side of the vehicle depending on optional equipment and type of vehicle service. Coil springs come in a various rates; be sure the correct spring is in use.

The components of the shock assembly listed below are serviceable:

- Shock rod nut
- Shock mount
- Shock rod bushings
- Upper spring isolator
- Dust shield
- Cup
- Jounce bumper
- Lower spring isolator
- Coil spring
- Strut

**OPERATION**

The shock absorber assembly cushions the ride of the vehicle, controlling vibration, jounce and rebound of the suspension.

The coil spring controls ride quality and maintains ride height.

The jounce bumper limits suspension travel and metal-to-metal contact under full jounce.

The shock absorber dampens jounce and rebound motions of the coil spring and suspension.

**KNUCKLE (REAR)****DESCRIPTION**

A cast iron rear knuckle is attached to each side of the vehicle through the upper control arm and ball joint, the rear shock assembly, the lateral links and the trailing link. The knuckle serves as a mounting point for the rear hub and bearing, tire and wheel, and rear brakes.

**OPERATION**

The knuckle moves up and down with the tire and wheel under jounce and rebound conditions while acting as a mount for the rear hub and bearing, tire and wheel, and rear brakes. The lateral movement of the rear knuckle is controlled using two lateral arms attached to the bottom of the knuckle and by the upper control arm attached to the top of the knuckle.

**HUB AND BEARING (REAR)****DESCRIPTION**

The hub and bearing is a combined rear wheel hub and wheel bearing unit. All vehicles are equipped with permanently lubricated and sealed for life rear hub and bearing assemblies. There is no periodic lubrication or maintenance recommended for these units.

The hub and bearing is mounted to the rear knuckle's spindle using a retaining nut. The tire and wheel assembly, and rear brake drum or disc attaches to the studs protruding from the hub flange with wheel mounting studs.



**DESCRIPTION AND OPERATION (Continued)****OPERATION**

The hub and bearing has internal bearings that allow it to rotate with the tire and wheel.

**UPPER CONTROL ARM (REAR)****DESCRIPTION**

An upper control arm is attached to the top of each rear knuckle, connecting the knuckle to the rear suspension crossmember.

The attachment of the upper control arm to the knuckle is achieved through a ball joint in the upper control arm. The upper control arm is bolted to the rear suspension crossmember using a pivot bar which is rubber isolated from the upper control arm.

**OPERATION**

The upper control arm supports the upper end of the knuckle and allows for the up and down movement of the suspension under jounce and rebound travel.

**LATERAL LINKS****DESCRIPTION**

The lateral links connect the lower front and rear of the knuckle to the rear crossmember. They have rubber isolator bushings at each end to isolate suspension noise from the body of the vehicle. The forward link allows for stabilizer bar attachment through stabilizer bar attachment links.

**OPERATION**

The lateral movement of the rear knuckle is controlled by the lateral links connecting the front and rear of the knuckle to the rear suspension crossmember. The metal sleeves of the links are adjustable for setting rear wheel alignment.

**TRAILING LINK****DESCRIPTION**

The trailing link on each side of the vehicle bolts to the bottom of the knuckle and to a bracket attached to the floor pan of the vehicle. The trailing link is steel and has rubber isolator bushings, retainer washers and nuts at each end to isolate suspension noise from the body of the vehicle.

**OPERATION**

Fore and aft movement of the knuckle is controlled by a trailing link.

**STABILIZER BAR (REAR)****DESCRIPTION**

The stabilizer bar interconnects the forward lateral links of the vehicle's rear suspension and is attached to the rear suspension crossmember of the vehicle.

Attachment of the stabilizer bar to the rear crossmember of the vehicle is through 2 rubber-isolator bushings and bushing retainers. The stabilizer bar to lateral link attachment is done utilizing a rubber isolated stabilizer bar attaching link. All parts of the stabilizer bar are serviceable, and the stabilizer bar to rear suspension isolator bushings are split for easy removal and installation. The split in the stabilizer bar to crossmember bushing must be positioned toward the front of the vehicle, when the stabilizer bar is installed on the vehicle.

**OPERATION**

Jounce and rebound movements affecting one rear wheel of the vehicle are partially transmitted to the opposite wheel of the vehicle through the stabilizer bar to stabilize body roll.

**DIAGNOSIS AND TESTING****SHOCK ASSEMBLY (REAR)**

- (1) Inspect for damaged or broken coil springs.
- (2) Inspect for torn or damaged shock absorber dust shield.
- (3) Inspect for damaged lower spring isolator.
- (4) Lift dust boot and inspect shock absorber for evidence of fluid running from the upper end of fluid reservoir. (Actual leakage will be a stream of fluid running down the side and dripping off lower end of unit). A slight amount of seepage between the shock absorber rod and shock absorber rod seal is not unusual and does not affect performance of the shock absorber. Also inspect jounce bumpers for signs of damage or deterioration.

**KNUCKLE (REAR)**

Inspect the knuckle for physical damage. If it is determined that the knuckle is cracked, bent or broken when servicing the vehicle, no attempt is to be made to repair or to straighten the knuckle. The rear knuckle is not a repairable component of the rear suspension and must be replaced if found to be damaged in any way.

**HUB AND BEARING (REAR)**

The rear hub and bearing assembly is designed for the life of the vehicle and should require no maintenance. The following procedure may be used for evaluation of bearing condition.

## DIAGNOSIS AND TESTING (Continued)

With wheel and brake drum removed, rotate flanged outer ring of hub. Excessive roughness, lateral play or resistance to rotation may indicate dirt intrusion or bearing failure. If the rear wheel bearings exhibit these conditions during inspection, the hub and bearing assembly should be replaced.

Damaged bearing seals and resulting excessive grease loss may also require bearing replacement. Moderate grease loss from bearing is considered normal and should not require replacement of the hub and bearing assembly.

### UPPER CONTROL ARM (REAR)

Inspect the control arm for physical damage. If it is determined that the upper control arm is broken or bent, the upper control arm must be replaced. The rear suspension upper control arm is not a repairable component and no attempt is to be made to repair or to straighten it. The upper control arm must be replaced if found to be damaged in any way.

Inspect the control arm pivot bushings for deterioration. If found to need replacement, the upper control arm is to be replaced.

The rear control arm, control arm bushings, and pivot bar are serviced as a complete assembly on this vehicle. Do not attempt to disassemble the control arm from the pivot bar to service the rear control arm bushings.

The only component on the upper control arm that is serviceable is the rear upper ball joint and its seal.

### BALL JOINT (REAR UPPER)

With the weight of the vehicle resting on the road wheels, grasp the grease fitting and with no mechanical assistance or added force, attempt to move the grease fitting.

If the ball joint is worn, the grease fitting will move easily. If movement is noted, replacement of the ball joint is required.

### LATERAL LINKS

Inspect the lateral link isolator bushings and sleeves for signs of damage or deterioration. If the lateral link isolator bushings or sleeves are damaged or are deteriorated, replacement of the lateral link assembly will be required. The isolator bushings are not serviceable as a separate component of the lateral link assembly.

Inspect the lateral links for signs of contact with the ground or road debris which has bent or caused other damage to the lateral link. If the lateral link is bent or damaged, the lateral link will require replacement. **Do not attempt to repair or straighten a lateral link.**

**CAUTION: Do not apply heat to the lateral link adjusting screws or to the jam nuts, when loosening or adjusting the lateral links.**

### TRAILING LINK

Inspect the trailing link bushings and retainers for signs of deterioration or damage. If the trailing link bushings are deteriorated or the retainers are damaged, replacement of the trailing link bushings and or the retainers will be required. The bushings and retainers are serviceable as separate components of the trailing link.

Inspect the trailing link for signs of contact with the ground or road debris which has bent or caused other damage to the trailing link. If the trailing link is bent or damaged the trailing link will require replacement. Do not ever attempt to repair or straighten a trailing link.

### STABILIZER BAR (REAR)

Inspect the stabilizer bar for damage or bending.

Inspect for broken or distorted stabilizer bar bushings, and bushing retainers. When inspecting the stabilizer bar bushings, be sure that the slit in the bushings are positioned so that it is facing toward the front of the vehicle.

Inspect the bushings and sleeves in the stabilizer bar attaching links for damage or deterioration. Inspect the stabilizer bar attaching link to ensure it is not bent or broken. If any of these conditions are present when inspecting the attaching links, replacement of the attaching link is required.

## SERVICE PROCEDURES

### LUBRICATION

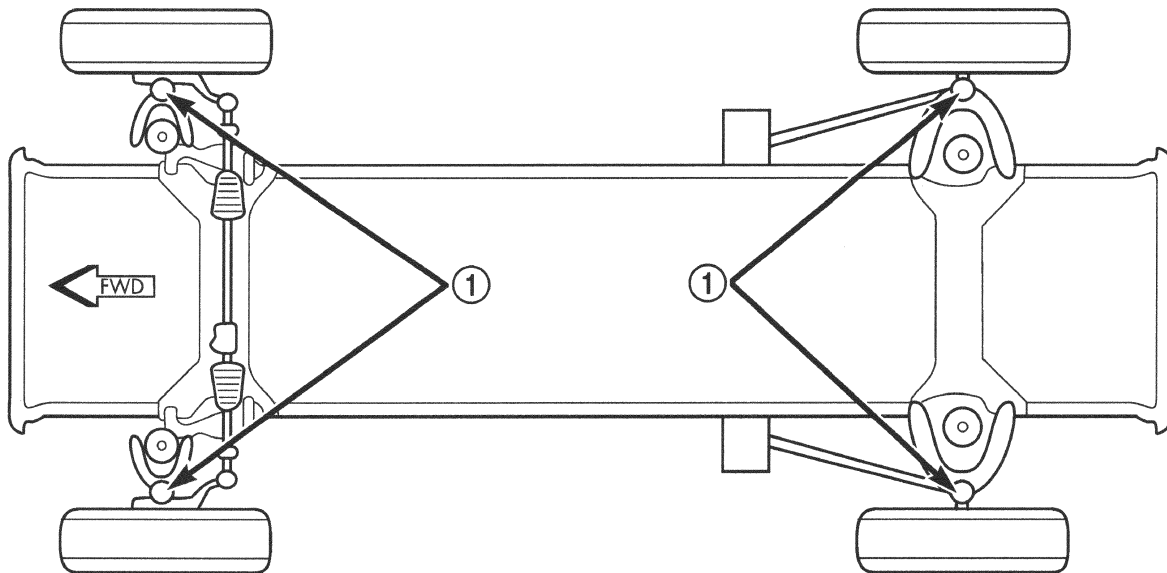
The only serviceable lubrication points on the suspension are the upper ball joints (Fig. 2). All other joints are sealed for life. Lubricate the upper ball joints until a slight swelling is noticed in the ball joint seal boots. Do not overfill the seal boots. Follow the vehicles maintenance schedule.

## REMOVAL AND INSTALLATION

### SERVICE WARNINGS AND CAUTIONS

**WARNING: DO NOT REMOVE A SHOCK ROD NUT WHILE THE SHOCK ASSEMBLY IS INSTALLED IN VEHICLE, OR BEFORE THE SHOCK ASSEMBLY SPRING IS COMPRESSED.**

## REMOVAL AND INSTALLATION (Continued)



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Fig. 2 Lubrication Points

1 - UPPER BALL JOINTS

**CAUTION:** Only frame contact or wheel lift hoisting equipment can be used on vehicles having a fully independent rear suspension. Vehicles with independent rear suspension can not be hoisted using equipment designed to lift a vehicle by the rear axle. If this type of hoisting equipment is used damage to rear suspension components will occur.

**NOTE:** If a rear suspension component becomes bent, damaged or fails, no attempt should be made to straighten or repair it. Always replace it with a new component.

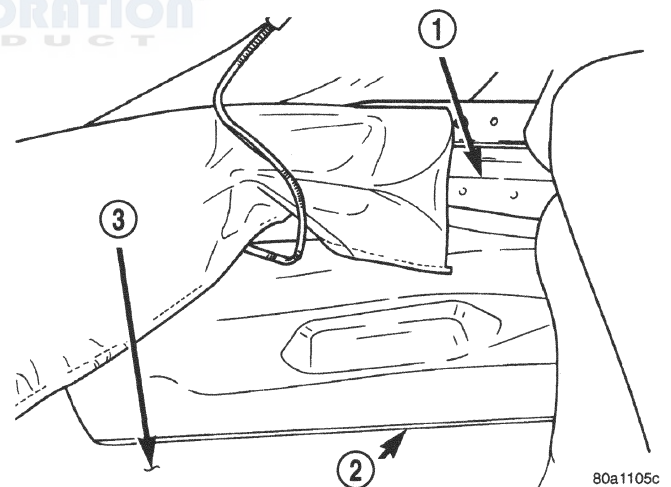
## SHOCK ASSEMBLY (REAR)

**NOTE:** Access for the nuts attaching the rear shock absorber upper mount is from the passenger compartment of the vehicle. The top of the vehicle must be up to access the attaching nuts.

## REMOVAL

(1) Remove the plastic access panel (Fig. 3) in the convertible top storage well. Refer to Group 23 Body in this service manual, for the required procedure to remove the access panel.

(2) Roll back the sound matting in the corner of the convertible top storage well to access the shock absorber attaching nuts.



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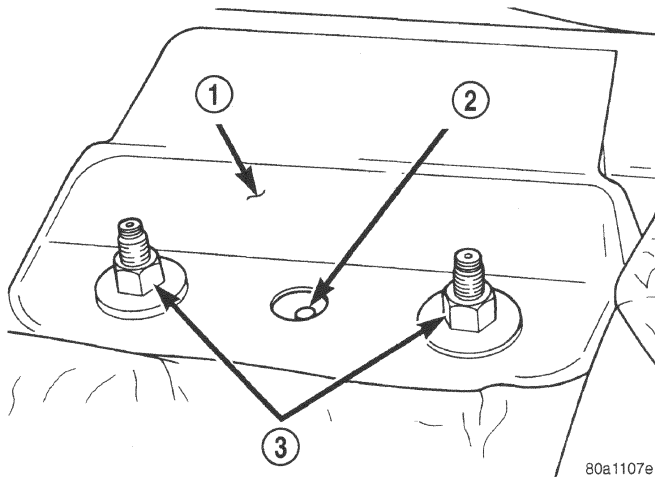
Fig. 3 Access Panel

- 1 - VEHICLE QUARTER PANEL
- 2 - REMOVE THIS PANEL
- 3 - CONVERTIBLE TOP STORAGE WELL

(3) Remove the 2 nuts (Fig. 4) attaching the shock absorber upper mount/spring seat to the body of the vehicle.

(4) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

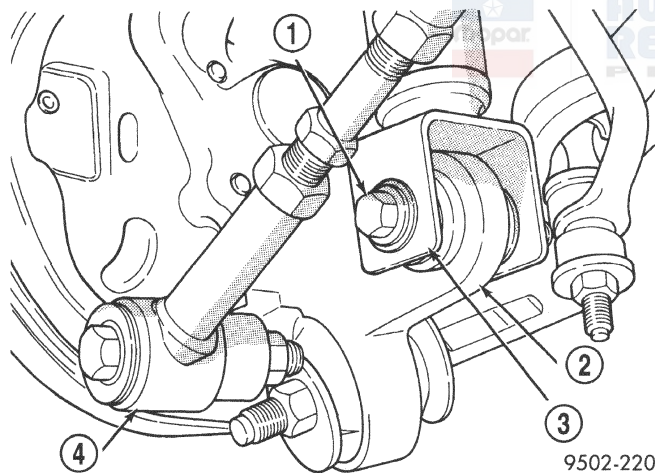


**REMOVAL AND INSTALLATION (Continued)****Fig. 4 Shock Absorber Upper Mount Attaching Nuts**

- 1 - VEHICLE BODY
- 2 - SHOCK ABSORBER
- 3 - SHOCK ABSORBER MOUNTING STUDS

(5) Remove the rear wheel and tire from the vehicle.

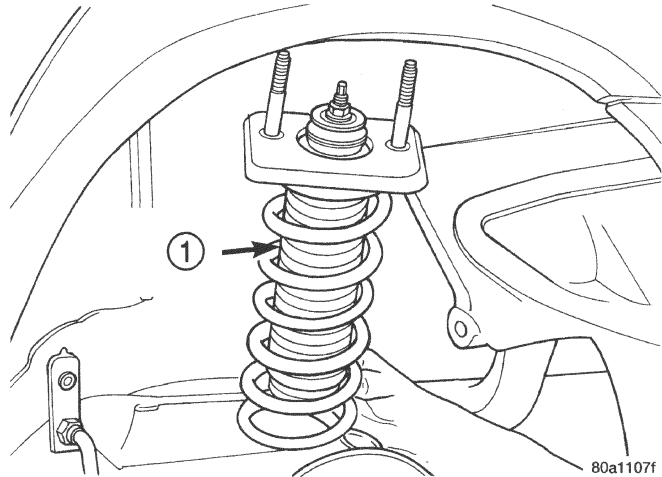
(6) Remove bolt attaching shock absorber to rear knuckle (Fig. 5).

**Fig. 5 Shock Absorber Attachment To Knuckle**

- 1 - ATTACHING BOLT
- 2 - REAR KNUCKLE
- 3 - SHOCK ABSORBER CLEVIS BRACKET
- 4 - LATERAL LINK

(7) Remove the shock absorber from the vehicle using the following procedure: First remove the shock absorber from the rear knuckle. Then remove the shock absorber upper mount from the body of the vehicle. For the required clearance to remove the shock absorber upper mount from the body it may be necessary to push down on the rear suspension.

(8) Move shock absorber downward and tilt top of shock outward. Then remove shock absorber from vehicle through top of wheel opening (Fig. 6).

**Fig. 6 Shock Absorber Removal**

- 1 - SHOCK ABSORBER ASSEMBLY

**INSTALLATION**

(1) Install shock absorber back in vehicle using the reverse sequence of removal (Fig. 6).

(2) Install upper shock absorber mount into the mounting holes in rear shock tower.

(3) Push down on rear knuckle to obtain clearance and then install shock absorber clevis bracket on rear knuckle.

(4) Align clevis bracket on shock absorber with bushing in knuckle. Install and tighten bolt (Fig. 5) to a torque of 95 N·m (70 ft. lbs.).

(5) Lower vehicle far enough to gain access to the passenger compartment of the vehicle.

(6) Install and tighten the 2 shock absorber mounting bracket attaching nuts (Fig. 4) to a torque of 54 N·m (40 ft. lbs.).

(7) Install the sound matting over the top of the shock absorber attaching nuts.

(8) Install the plastic access panel (Fig. 3) in the convertible top storage well. Refer to Group 23 Body in this service manual, for the required procedure to install the access panel.

(9) Install wheel and tire assembly on vehicle. Then torque all wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat tightening sequence to full specified torque of 135 N·m (100 ft. lbs.).

(10) Lower the vehicle to the ground.

## REMOVAL AND INSTALLATION (Continued)

### KNUCKLE (REAR)

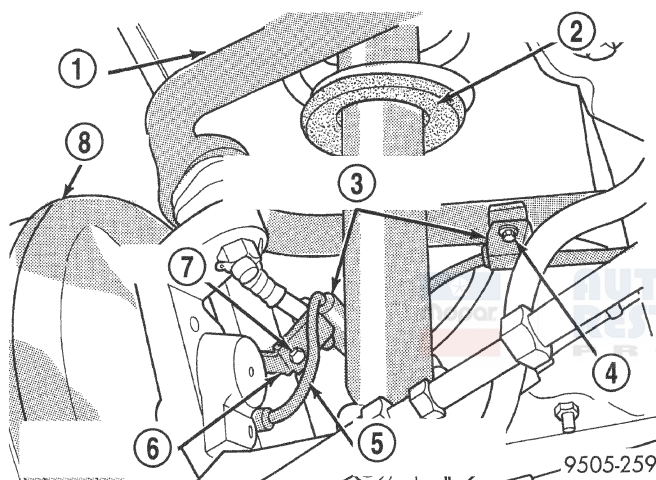
#### REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the rear wheel and tire assembly from the vehicle.

(3) Remove rear brake drum from rear hub and bearing assembly.

(4) If vehicle is equipped with antilock brakes remove the rear wheel speed sensor from the brake support plate and brake flex hose routing bracket (Fig. 7).



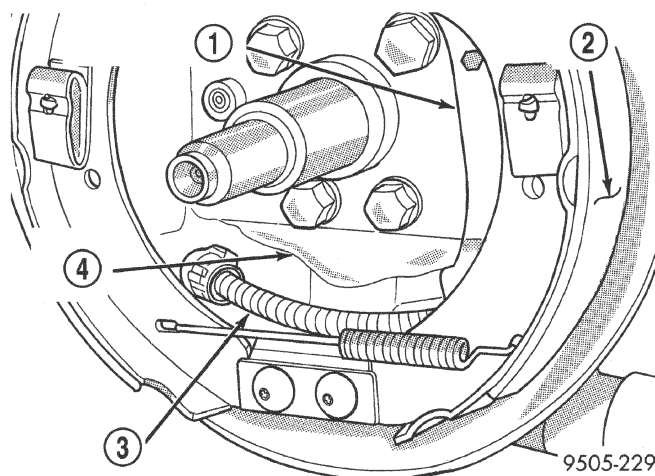
**Fig. 7 Rear Wheel Speed Cable Routing And Attachment**

- 1 - UPPER CONTROL ARM
- 2 - SHOCK ABSORBER
- 3 - SPEED SENSOR CABLE ROUTING CLIPS
- 4 - BOLT
- 5 - SPEED SENSOR CABLE
- 6 - BRAKE FLEX HOSE BRACKET
- 7 - BOLT
- 8 - BRAKE DRUM

(5) Remove the park brake cable from the park brake actuating lever (Fig. 8). Then remove the park brake cable from the rear brake support plate (Fig. 9). Park brake cable is removed from brake support plate using this procedure. Position a 1/2 inch box end wrench over cable retainer (Fig. 9) to collapse retaining tabs. Then pull rear brake cable from brake support plate.

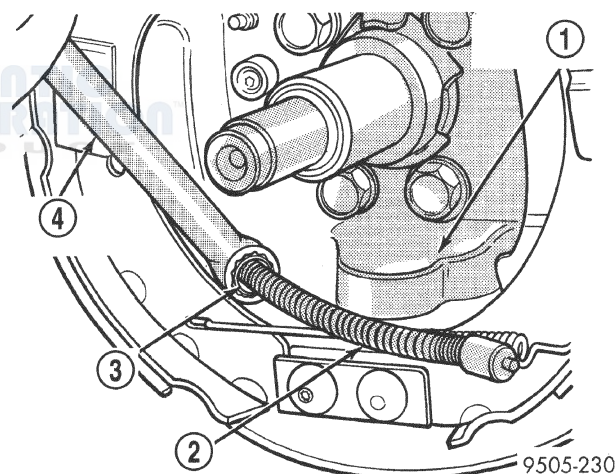
(6) Remove the rear hub/bearing assembly retaining nut (Fig. 10). Then remove the washer and the hub/bearing assembly from the knuckle.

(7) Remove the 4 bolts (Fig. 11) attaching rear brake support plate to knuckle. Then remove brake



**Fig. 8 Park Brake Cable Attachment To Actuating Lever**

- 1 - PARK BRAKE ACTUATING LEVER
- 2 - TRAILING BRAKE SHOE
- 3 - PARK BRAKE CABLE
- 4 - BRAKE SUPPORT PLATE



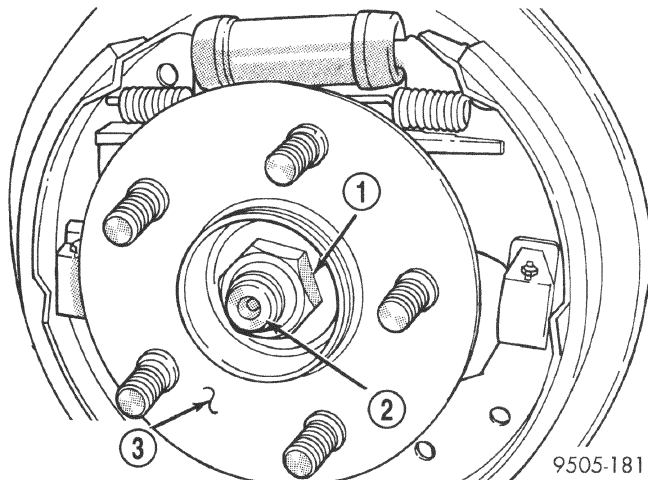
**Fig. 9 Park Brake Cable Removal From Brake Support Plate**

- 1 - REAR BRAKE SUPPORT PLATE
- 2 - PARK BRAKE CABLE
- 3 - PARK BRAKE CABLE RETAINER
- 4 - 1/2" BOX END WRENCH

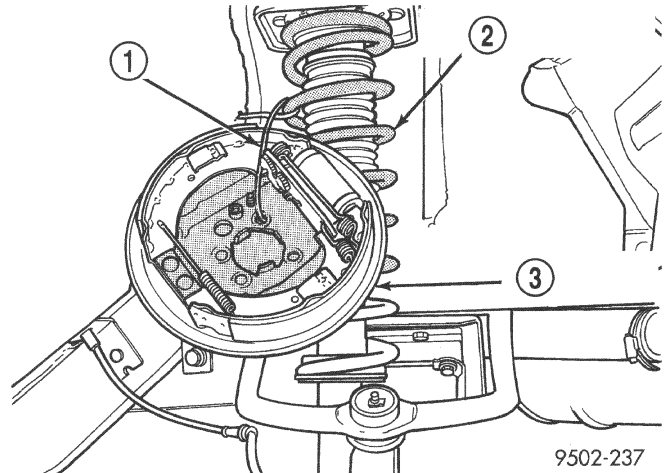
support plate, brake shoes and wheel cylinder as an assembly from rear knuckle. **It is not necessary to remove brake flex hose from wheel cylinder when removing support plate.** Brake support plate when removed, must be supported using mechanics wire as shown in (Fig. 12).

(8) Remove the nuts and bolts attaching the forward and rear lateral links (Fig. 13) to the rear knuckle.

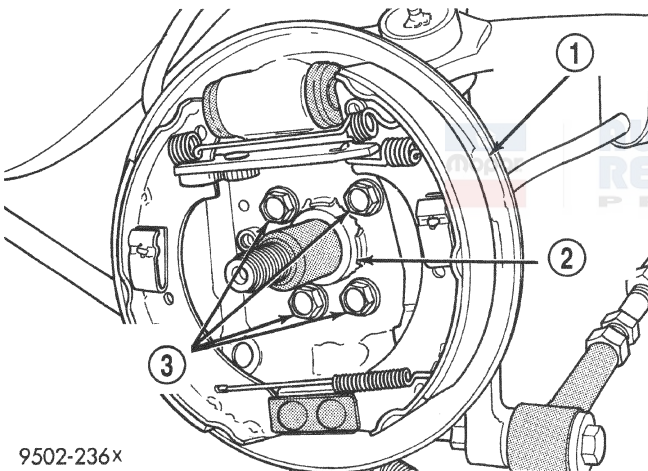


**REMOVAL AND INSTALLATION (Continued)****Fig. 10 Hub/Bearing Assembly Retaining Nut**

- 1 - RETAINING NUT
- 2 - SPINDLE
- 3 - HUB/BEARING ASSEMBLY

**Fig. 12 Correctly Stored Rear Brake Support Plate**

- 1 - WIRE HANGER
- 2 - REAR SHOCK ABSORBER ASSEMBLY
- 3 - REAR BRAKE SUPPORT PLATE

**Fig. 11 Rear Brake Support Plate Mounting Bolts**

- 1 - REAR BRAKE SUPPORT PLATE
- 2 - REAR KNUCKLE
- 3 - BRAKE SUPPORT PLATE ATTACHING BOLTS

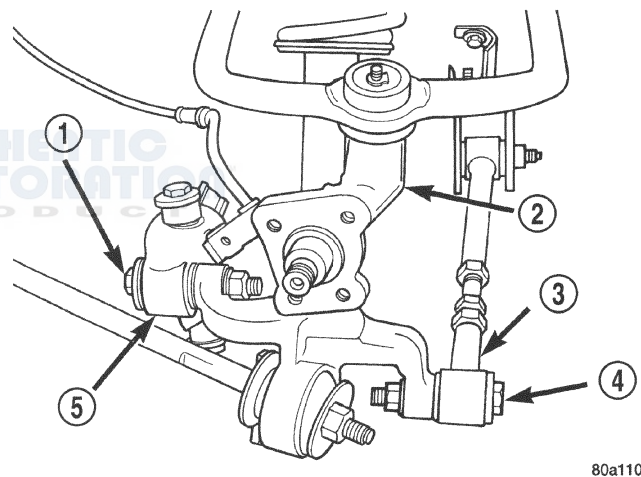
(9) Remove cotter pin and castle nut attaching upper control arm ball joint to knuckle.

(10) Remove ball joint stud from knuckle using Puller, Special Tool, CT-1106 (Fig. 14). When using puller, install castle nut on ball joint stud (Fig. 14) to protect threads from damage.

(11) Remove the nut and washer attaching the trailing link to the rear knuckle. Use a wrench on the flat of the trailing link to keep it from turning when removing nut (Fig. 15).

(12) Remove the shock absorber clevis bracket to knuckle attaching nut and bolt (Fig. 16).

(13) Remove the knuckle assembly from the vehicle.

**Fig. 13 Lateral Link Attachment To Rear Knuckle**

- 1 - BOLT
- 2 - KNUCKLE
- 3 - REAR LATERAL LINK
- 4 - BOLT
- 5 - FORWARD LATERAL LINK

**INSTALLATION**

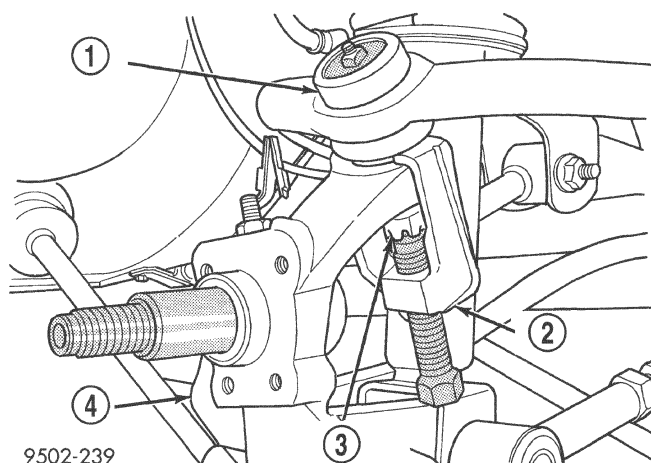
(1) Install knuckle on clevis bracket of rear shock absorber. Then install clevis bracket to shock absorber attaching bolt with head of bolt facing rear of vehicle (Fig. 16).

**CAUTION:** When installing trailing link bushing retainers, retainers must be installed with cupped side of retainer facing away from bushing and knuckle (Fig. 17).

(2) Install knuckle on trailing link. Install the trailing link outer bushing, gold bushing retainer and

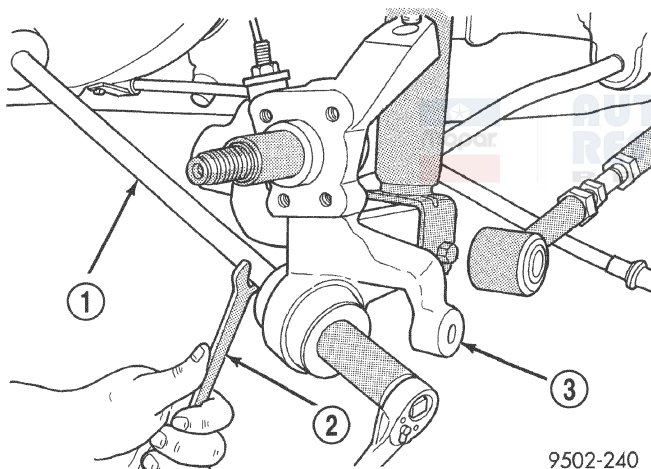


## REMOVAL AND INSTALLATION (Continued)



**Fig. 14 Removing Ball Joint Stud From Knuckle**

- 1 - BALL JOINT
- 2 - SPECIAL TOOL CT1106
- 3 - BALL JOINT STUD
- 4 - KNUCKLE



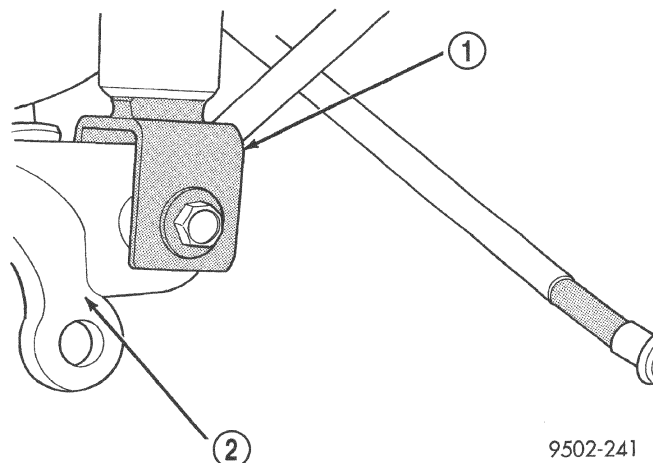
**Fig. 15 Trailing Link Attachment To Rear Knuckle**

- 1 - TENSION NUT
- 2 - WRENCH
- 3 - KNUCKLE

retaining nut on trailing link (Fig. 17). Using a large adjustable wrench, to keep trailing link from rotating securely tighten the trailing link retaining nut (Fig. 17) to a torque of 99 N·m (73 ft. lbs.).

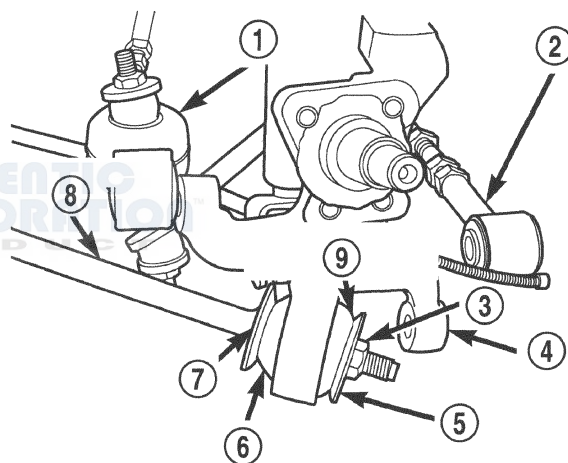
(3) Install the upper ball joint in the knuckle. Install and tighten the ball joint stud castle nut to a torque of 85 N·m (63 ft. lbs.). Install cotter pin in ball joint stud.

(4) Install the front and rear lateral links and attaching nuts and bolts on the knuckle (Fig. 13). Tighten the lateral links to knuckle attaching bolts and nuts to 108 N·m (80 ft. lbs.).



**Fig. 16 Shock Absorber Attachment To Knuckle**

- 1 - SHOCK ABSORBER CLEVIS BRACKET
- 2 - KNUCKLE

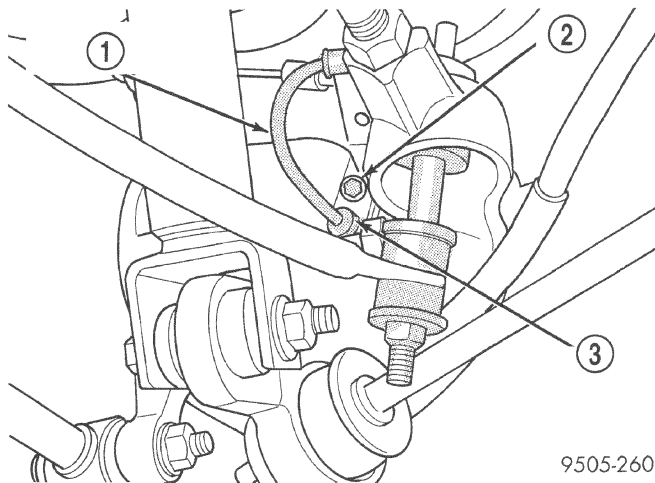


**Fig. 17 Trailing Link Bushing And Retainer Installation**

- 1 - FORWARD LATERAL ARM
- 2 - REAR LATERAL ARM
- 3 - NUT
- 4 - KNUCKLE
- 5 - OUTER TRAILING LINK RETAINER (GOLD)
- 6 - INNER TRAILING LINK BUSHING
- 7 - INNER TRAILING LINK RETAINER (BLACK)
- 8 - TRAILING LINK
- 9 - OUTER TRAILING LINK BUSHING

(5) Install rear brake support plate assembly onto the knuckle. Install the 4 bolts (Fig. 11) attaching rear brake support plate to rear knuckle. Tighten the attaching bolts to a torque of 61 N·m (45 ft. lbs.).

(6) If vehicle is equipped with ABS brakes, install speed sensor head into rear brake support plate (Fig. 18). Torque speed sensor head mounting bolt to 7 N·m (60 in. lbs.).

**REMOVAL AND INSTALLATION (Continued)**

**Fig. 18 Speed Sensor Head Attachment To Brake Support Plate**

- 1 - SPEED SENSOR CABLE
- 2 - BOLT
- 3 - SPEED SENSOR HEAD

(7) Attach routing bracket for speed sensor cable to brake flex hose bracket and securely tighten attaching bolt (Fig. 7).

(8) Install park brake cable into brake support plate. Ensure cable retainer is securely holding cable to support plate. Then connect park brake cable to park brake lever on brake shoe.

(9) Install rear hub and bearing assembly on knuckle and install hub and bearing assembly retaining nut. Tighten retaining nut to a torque of 250 N·m (185 ft. lbs.).

(10) Install the brake drum on the hub/bearing assembly.

(11) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(12) Lower vehicle.

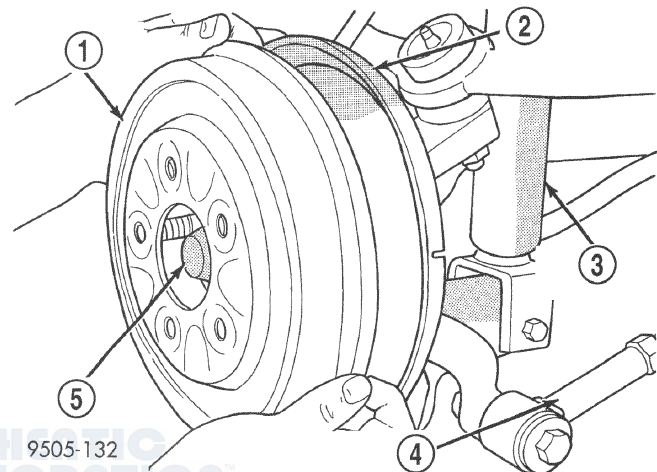
(13) Check and reset rear wheel alignment to specifications if required. Refer to Front And Rear Alignment Setting Procedure in the Wheel Alignment Check And Adjustment section in this group of the service manual for the required alignment setting procedure.

**HUB AND BEARING (REAR)****REMOVAL**

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual for the required lifting procedure to be used for this vehicle.

(2) Remove rear wheel and tire assembly.

(3) If equipped with rear drum brakes, remove brake drum (Fig. 19) from rear hub and bearing assembly by removing the clips, then pulling the drum straight off the wheel mounting studs. If equipped with rear disc brakes, remove the rear caliper following the procedure found in REMOVAL AND INSTALLATION of the BASE BRAKE SYSTEM section of the group BRAKES. Remove the brake rotor by pulling the rotor straight off the wheel mounting studs.



**Fig. 19 Rear Brake Drum Removal**

- 1 - REAR BRAKE DRUM
- 2 - REAR BRAKE SUPPORT PLATE
- 3 - SHOCK ASSEMBLY
- 4 - REAR LATERAL ARM
- 5 - HUB/BEARING ASSEMBLY

(4) Remove dust cap from rear hub and bearing assembly by prying it off.

(5) Remove hub and bearing assembly to rear spindle retaining nut (Fig. 20).

(6) Remove rear hub and bearing from the spindle by pulling it straight off the spindle by hand.

**INSTALLATION**

(1) Install the hub and bearing assembly on the knuckle spindle. Install a NEW retaining nut (Fig. 20). Tighten the retaining nut to a torque of 250 N·m (185 ft. lbs.).

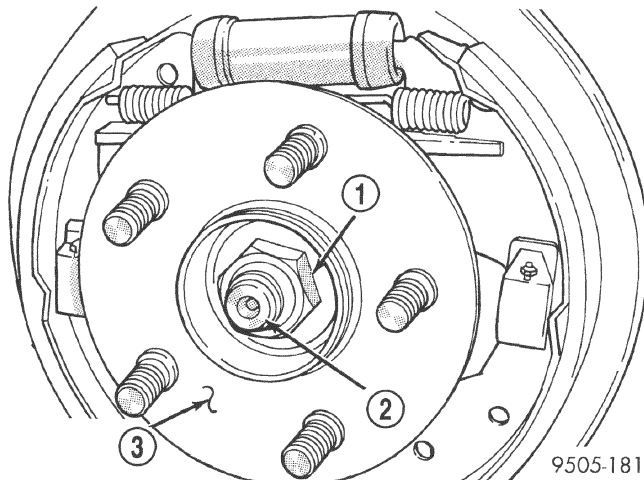
(2) Install the hub and bearing dust cap using a soft faced hammer.

(3) Install the brake drum or brake rotor on the hub and bearing.

(4) If equipped with rear disc brakes, install the rear caliper following the procedure found in REMOVAL AND INSTALLATION of the BASE BRAKE SYSTEM section of the group BRAKES.

(5) Install the rear tire and wheel assembly on vehicle. Tighten all wheel stud nuts in criss-cross

## REMOVAL AND INSTALLATION (Continued)



**Fig. 20 Hub/Bearing Assembly Retaining Nut**

- 1 - RETAINING NUT
- 2 - SPINDLE
- 3 - HUB/BEARING ASSEMBLY

pattern to one-half the specified torque. Then repeat pattern, fully tightening the stud nuts to a torque of 129 N·m (95 ft. lbs.).

(6) Lower the vehicle.

## UPPER CONTROL ARM (REAR)

**NOTE:** The rear control arm, control arm bushings, and pivot bar are serviced as a complete assembly on this vehicle. Do not attempt to disassemble the control arm from the pivot bar to service the rear control arm bushings. The ball joint and ball joint seal are to be replaced with the control arm removed from the vehicle.

## REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

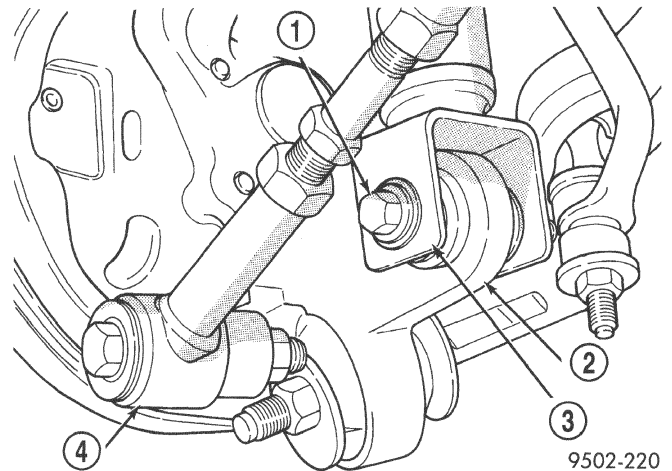
(2) Remove both rear wheel and tire assemblies from the vehicle.

(3) Remove the shock absorber clevis bracket to rear knuckle attaching bolt and nut (Fig. 21) on both sides of the vehicle.

(4) Remove muffler support bracket from rear frame rail (Fig. 22).

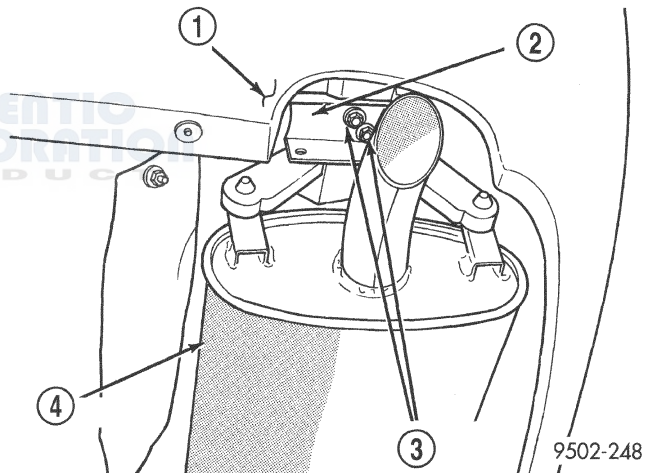
(5) Remove the rear exhaust pipe hanger bracket from the rear suspension crossmember (Fig. 23). Let exhaust system drop down as far as possible.

(6) On only the side of the vehicle requiring control arm removal, separate the control arm ball joint from the rear knuckle using following procedure.



**Fig. 21 Shock Absorber To Knuckle Attaching**

- 1 - ATTACHING BOLT
- 2 - REAR KNUCKLE
- 3 - SHOCK ABSORBER CLEVIS BRACKET
- 4 - LATERAL LINK



**Fig. 22 Muffler Support Bracket**

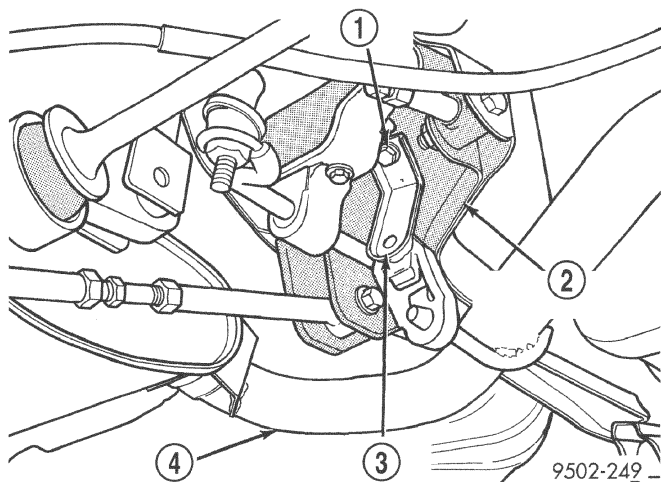
- 1 - REAR FASCIA
- 2 - MUFFLER SUPPORT BRACKET
- 3 - ATTACHING BOLTS
- 4 - MUFFLER

- Remove cotter pin and castle nut attaching upper control arm ball joint to knuckle.

- Remove ball joint stud from knuckle using Puller, Special Tool, CT- 1106 (Fig. 24). When using puller, install castle nut on ball joint stud to protect threads from damage.

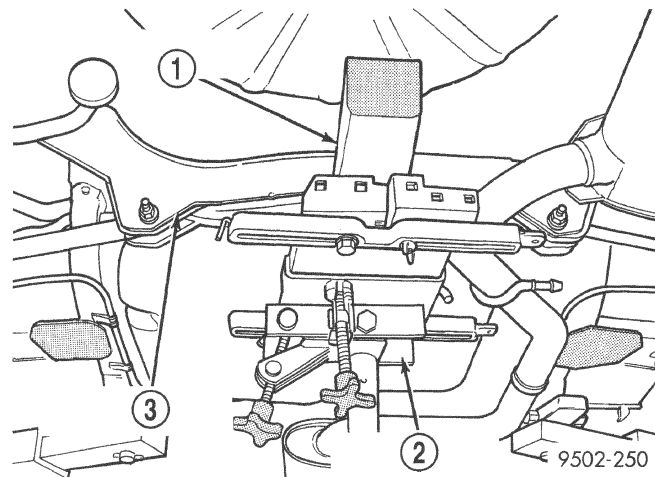
(7) Position a transmission jack and wooden block under the center of the rear suspension crossmember to support and lower crossmember during removal (Fig. 25).



**REMOVAL AND INSTALLATION (Continued)**

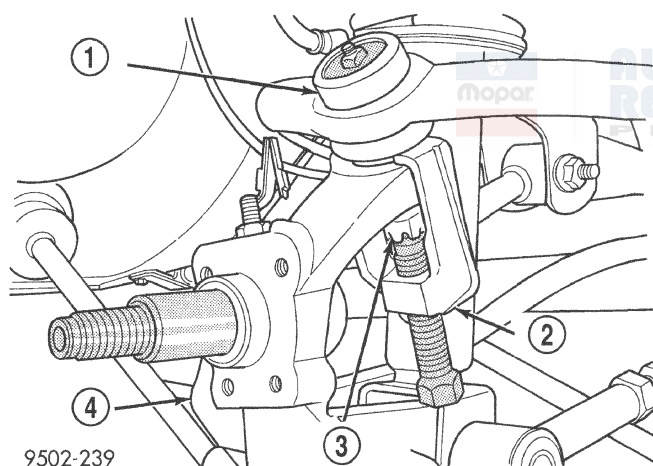
**Fig. 23 Exhaust Pipe Hanger At Rear Suspension Crossmember**

- 1 - BOLT
- 2 - REAR SUSPENSION CROSSMEMBER
- 3 - HANGER BRACKET
- 4 - EXHAUST PIPE



**Fig. 25 Lowering And Supporting Rear Suspension Crossmember**

- 1 - WOODEN BLOCK
- 2 - TRANSMISSION JACK
- 3 - REAR SUSPENSION CROSSMEMBER



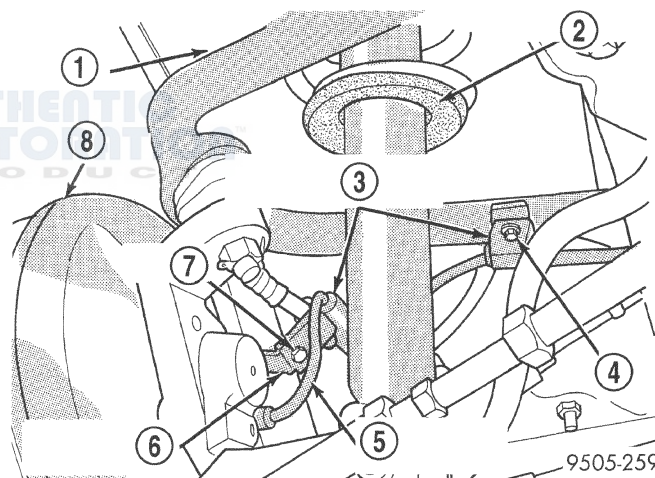
**Fig. 24 Ball Joint Stud Removal From Knuckle**

- 1 - BALL JOINT
- 2 - SPECIAL TOOL CT1106
- 3 - BALL JOINT STUD
- 4 - KNUCKLE

(8) If vehicle is equipped with antilock brakes, remove routing clips for wheel speed sensor cable from brackets on both upper control arms (Fig. 26).

(9) Remove the 4 bolts (Fig. 27) attaching rear suspension crossmember to rear frame rails.

**CAUTION:** When lowering rear suspension crossmember do not put a strain on the rear brake flex hoses.

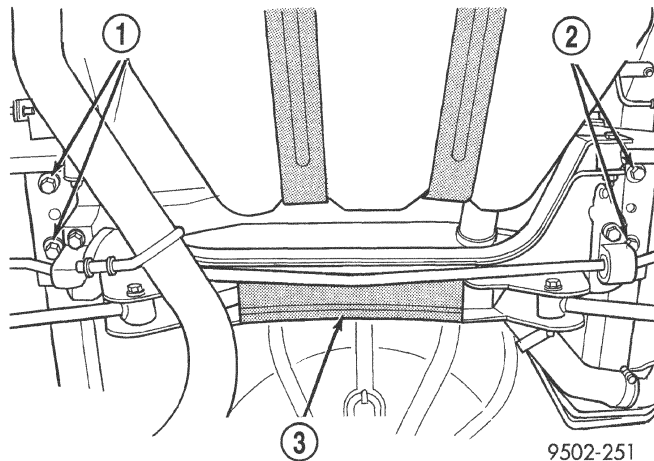


**Fig. 26 Speed Sensor Cable Attachment To Control Arm**

- 1 - UPPER CONTROL ARM
- 2 - SHOCK ABSORBER
- 3 - SPEED SENSOR CABLE ROUTING CLIPS
- 4 - BOLT
- 5 - SPEED SENSOR CABLE
- 6 - BRAKE FLEX HOSE BRACKET
- 7 - BOLT
- 8 - BRAKE DRUM

(10) Lower the rear suspension crossmember far enough to access the upper control arm pivot bar to crossmember attaching bolts.

## REMOVAL AND INSTALLATION (Continued)

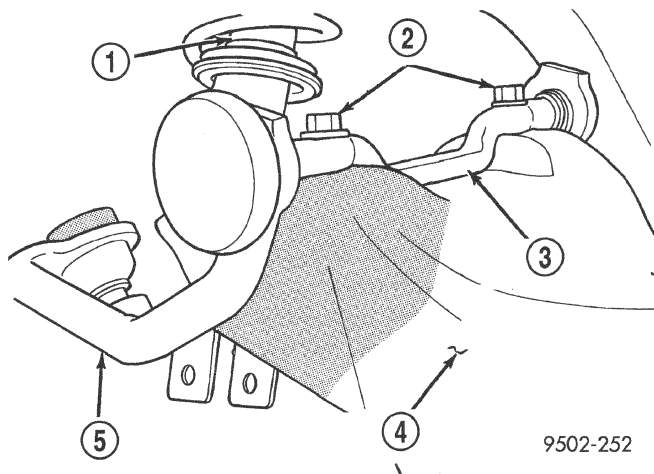


**Fig. 27 Crossmember Attachment To Frame Rails**

- 1 - ATTACHING BOLTS
- 2 - ATTACHING BOLTS
- 3 - REAR SUSPENSION CROSSMEMBER

**NOTE:** One flat washer is used at each upper control arm pivot bar attaching bolt. The flat washer is located between the pivot bar and the rear suspension crossmember. Be sure the washers are not lost when removing the pivot bar attaching bolts from the rear suspension crossmember.

(11) Remove the 2 bolts (Fig. 28) attaching the upper control arm to the rear suspension crossmember.



**Fig. 28 Upper Control Arm Attachment To Crossmember**

- 1 - SHOCK ABSORBER
- 2 - ATTACHING BOLTS
- 3 - UPPER CONTROL ARM PIVOT BAR
- 4 - REAR SUSPENSION CROSSMEMBER
- 5 - UPPER CONTROL ARM

(12) Remove the flat washers and the upper control arm from the rear suspension crossmember.

(13) Transfer any required components to the replacement control arm.

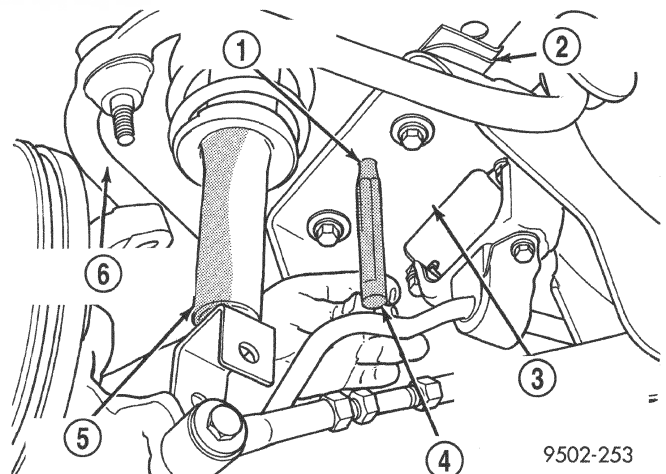
## INSTALLATION

**NOTE:** One flat washer is used at each upper control arm pivot bar attaching bolt. The flat washer is located between the pivot bar and the rear suspension crossmember. Be sure 1 flat washer is used at each bolt attaching the pivot bar to the rear suspension crossmember.

(1) Align the upper control arm pivot bar with the mounting holes in the rear suspension crossmember. Install the pivot bar attaching bolts and washers. Tighten the 2 pivot bar to crossmember attaching bolts (Fig. 28) to a torque of 108 N·m (80 ft. lbs.).

(2) Using transmission jack, raise rear suspension crossmember up to the rear frame rails and loosely install the 4 attaching bolts (Fig. 27).

(3) Position an appropriate size drift into the positioning hole in each side of rear suspension crossmember and crossmember locating holes in frame rails of the vehicle (Fig. 29). This is required to properly position rear suspension crossmember in the body of the vehicle. Then tighten the 4 crossmember to frame rail attaching bolts to 108 N·m (80 ft. lbs.). Remove drifts from rear suspension crossmember.



**Fig. 29 Locating Rear Suspension Crossmember In Vehicle**

- 1 - POSITIONING HOLE
- 2 - FRAME RAIL
- 3 - REAR SUSPENSION CROSSMEMBER
- 4 - DRIFT
- 5 - SHOCK ABSORBER
- 6 - UPPER CONTROL ARM

(4) Install upper ball joint stud in knuckle. Install and tighten the ball joint stud castle nut to a torque of 85 N·m (63 ft. lbs.). Install cotter pin in ball joint stud.



**REMOVAL AND INSTALLATION (Continued)**

(5) Remove transmission jack supporting rear suspension crossmember.

(6) Install muffler support bracket on rear frame rail (Fig. 22). Install rear exhaust pipe hanger on rear suspension crossmember (Fig. 23).

(7) Install the wheel speed sensor cable routing clip on upper control arm mounting bracket. Install and securely tighten attaching bolt (Fig. 26).

(8) Install the shock absorber clevis brackets (Fig. 21) on the rear knuckles. Tighten the shock absorber mounting bolts to a torque of 95 N·m (70 ft. lbs.).

(9) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

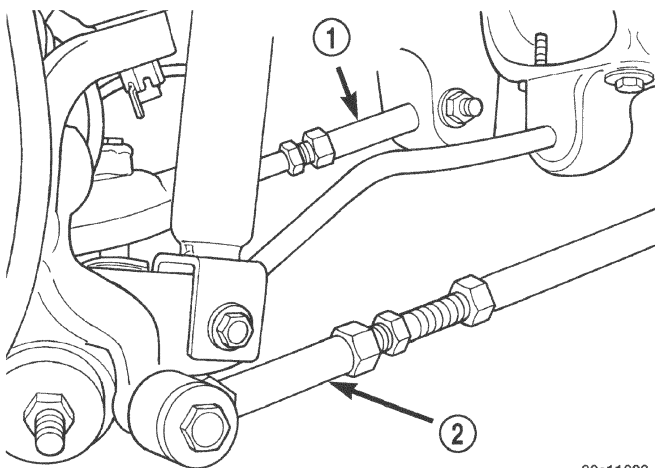
(10) Lower vehicle to the ground.

(11) Check and reset if required, rear wheel Camber and Toe to preferred specifications.

**LATERAL LINKS**

The rear suspension lateral links (Fig. 30) are only serviced as complete assemblies. The isolator bushings used in the lateral links are not serviced as separate components.

**CAUTION:** Do not attempt to straighten or repair a lateral link. Do not apply heat to the lateral link adjusting screws or to the jam nuts, when loosening or adjusting the lateral links.



**Fig. 30 Rear Suspension Lateral Links**

- 1 - FORWARD LATERAL LINK
- 2 - REAR LATERAL LINK

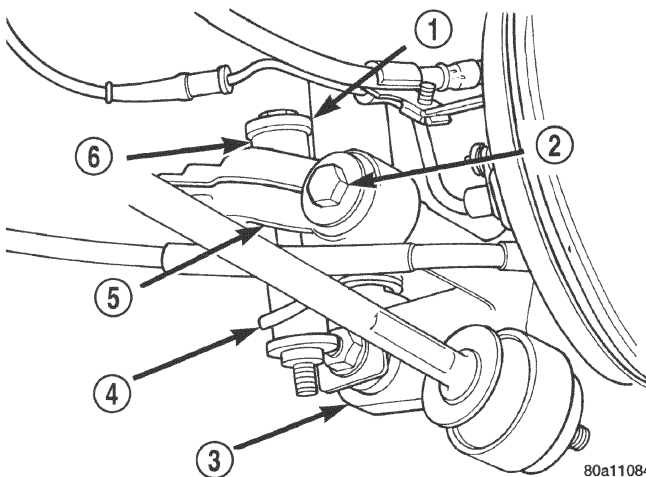
**FORWARD LATERAL LINK****REMOVE**

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for

the required lifting procedure to be used for this vehicle.

(2) Remove the rear wheel and tire assembly from the side of the vehicle requiring lateral link removal.

(3) Remove the rear stabilizer bar attaching link from the forward lateral link (Fig. 31).



**Fig. 31 Stabilizer Bar To Lateral Link Attachment**

- 1 - WASHER
- 2 - BOLT AND WASHER
- 3 - KNUCKLE
- 4 - STABILIZER BAR
- 5 - FORWARD LATERAL LINK
- 6 - STABILIZER BAR ATTACHING LINK

(4) Remove the nut, bolt and washer (Fig. 31) attaching the forward lateral link to the knuckle.

(5) Remove the nut and bolt attaching the lateral link to the rear suspension crossmember (Fig. 32).

(6) Remove the forward lateral link from the vehicle.

**INSTALL**

(1) Install the lateral link and the attaching nut and bolt at rear suspension crossmember (Fig. 32). **The forward lateral link is to be installed with the cup in cast portion facing down and toward rear knuckle (Fig. 31).**

(2) Install the lateral link and attaching nut, bolt and washer at rear knuckle (Fig. 31).

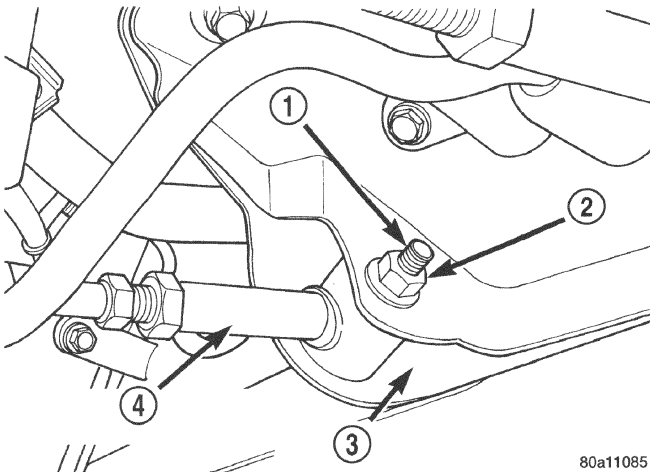
(3) Torque both lateral link attaching bolts to 108 N·m (80 ft. lbs.).

(4) Install the rear stabilizer bar attaching link, isolator bushings and attaching nut on the forward lateral link (Fig. 31). Tighten the attaching nut to a torque of 35 N·m (26 ft. lbs.).

(5) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

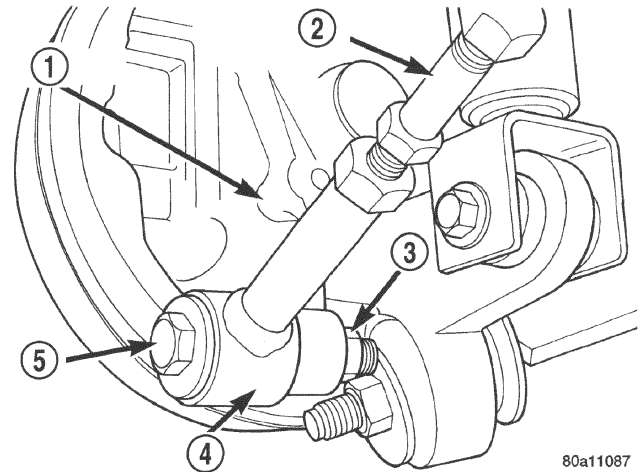


## REMOVAL AND INSTALLATION (Continued)



**Fig. 32 Lateral Link Attachment To Rear Suspension Crossmember**

- 1 - BOLT
- 2 - NUT
- 3 - REAR SUSPENSION CROSSMEMBER
- 4 - FORWARD LATERAL LINK



**Fig. 33 Rear Lateral Link Attachment To Knuckle**

- 1 - KNUCKLE
- 2 - ADJUSTING SCREW
- 3 - NUT
- 4 - REAR LATERAL LINK
- 5 - BOLT

(6) Lower vehicle to the ground.

(7) Check and reset rear wheel Camber and Toe to specifications if required. Refer to Front And Rear Alignment Setting Procedure in the Wheel Alignment Check And Adjustment section in this group of the service manual for the required alignment setting procedure.

## REAR LATERAL LINK

### REMOVE

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the rear wheel and tire assembly from the side of the vehicle requiring lateral link removal.

(3) Remove the nut, bolt and washer attaching the lateral link to the knuckle (Fig. 33).

(4) Remove the bolt (Fig. 34) and nut attaching the lateral link to the rear suspension crossmember.

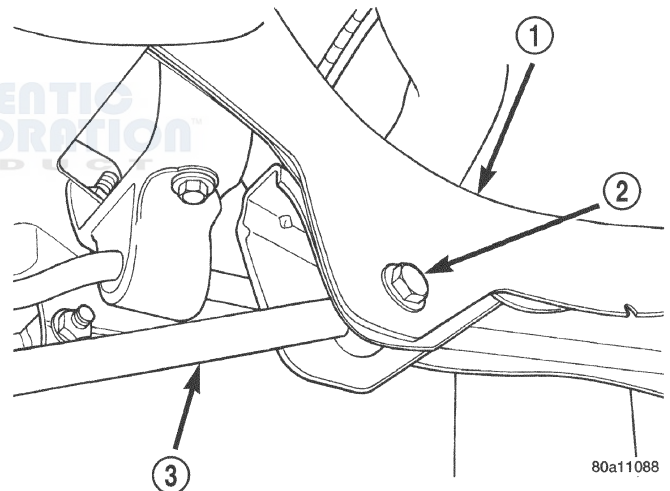
(5) Remove rear lateral link from vehicle.

### INSTALL

(1) Install the lateral link and the attaching nut and bolt at rear suspension crossmember (Fig. 34). **The rear lateral link is to be installed with the adjusting screw toward rear knuckle not rear suspension crossmember (Fig. 33).**

(2) Install the lateral link and the attaching nut, bolt and washer at rear knuckle (Fig. 33).

(3) Torque both lateral link attaching bolts to 108 N·m (80 ft. lbs.).



**Fig. 34 Lateral Link Attachment To Rear Suspension Crossmember**

- 1 - REAR SUSPENSION CROSSMEMBER
- 2 - BOLT
- 3 - REAR LATERAL LINK

(4) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(5) Lower vehicle to the ground.

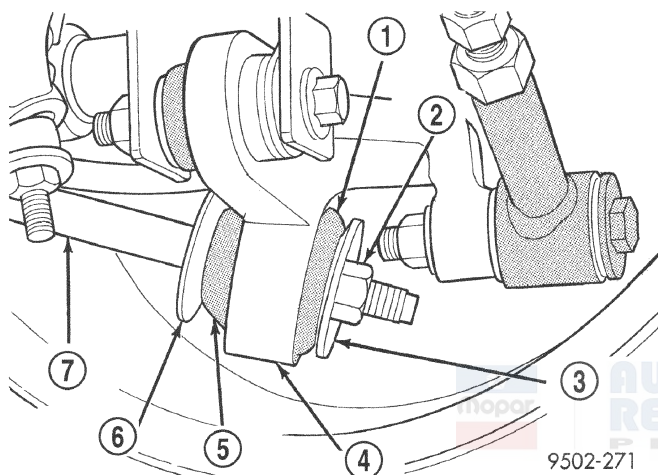
(6) Check and reset rear wheel Camber and Toe to specifications if required. Refer to Front And Rear Alignment Setting Procedure in the Wheel Alignment Check And Adjustment section in this group of the service manual for the required alignment setting procedure.

**REMOVAL AND INSTALLATION (Continued)****TRAILING LINK****REMOVAL**

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove rear wheel and tire assembly from the vehicle.

(3) At the knuckle, remove the nut, bushing retainer and outer trailing link bushing (Fig. 35) from the trailing link.



**Fig. 35 Trailing Link To Knuckle Attachment**

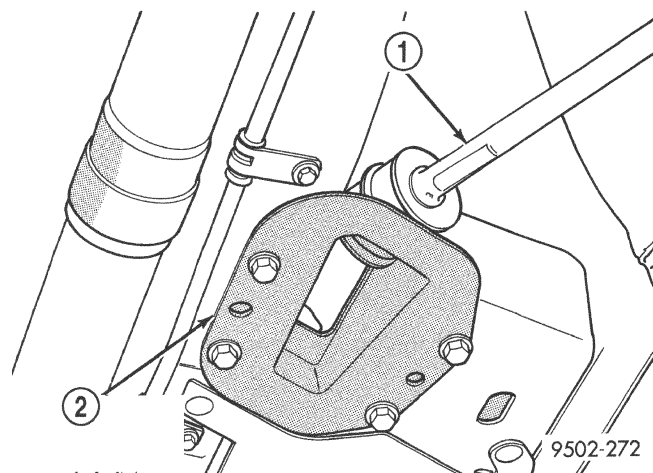
- 1 - BUSHING
- 2 - NUT
- 3 - BUSHING RETAINER
- 4 - KNUCKLE
- 5 - BUSHING
- 6 - BUSHING RETAINER
- 7 - TRAILING LINK

(4) Remove the 4 bolts (Fig. 36) attaching the trailing link hanger bracket to the floor pan and frame rail.

(5) Remove the trailing link and mounting bracket as an assembly from the vehicle.

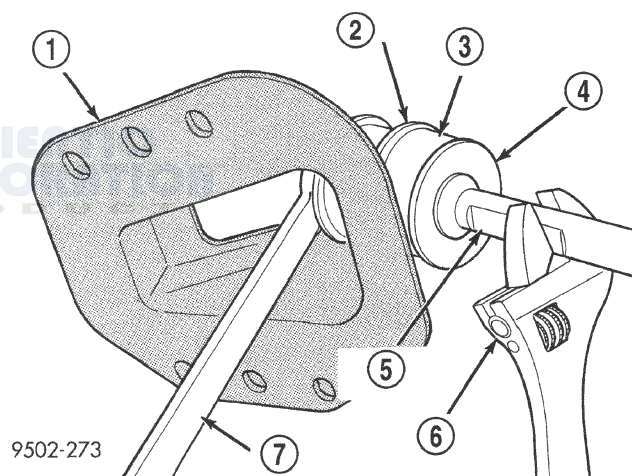
**CAUTION:** The installation position of the bushings and retainers on the trailing link is important. When separating the trailing link from the hanger bracket, note the position and orientation on the bushings and retainers to ensure they are re-installed correctly.

(6) Separate the trailing link from the hanger bracket. To separate trailing link from hanger bracket, use a large adjustable wrench on flat of trailing link to turn link while holding nut stationary (Fig. 37).



**Fig. 36 Trailing Link Hanger Bracket Attachment To Vehicle**

- 1 - TRAILING LINK
- 2 - TRAILING LINK HANGER BRACKET



**Fig. 37 Separating Trailing Link From Hanger Bracket**

- 1 - HANGER BRACKET
- 2 - SPACER
- 3 - BUSHING
- 4 - RETAINER
- 5 - TRAILING LINK
- 6 - ADJUSTABLE WRENCH
- 7 - WRENCH

**INSTALLATION**

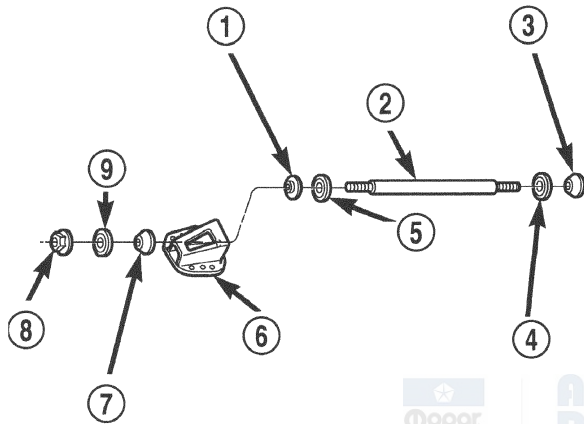
**CAUTION:** The inner and outer trailing link to hanger bracket bushings and retainers must be installed in their correct position on the trailing link. Do not reverse the position of the inner and outer trailing link bushing or retainers on the trailing link.



## REMOVAL AND INSTALLATION (Continued)

**NOTE:** When installing trailing link into hanger bracket, the flat on the trailing link (Fig. 37) must be positioned at the hanger bracket.

(1) Install the (black) inner bushing retainer, and inner bushing (Fig. 38) on the trailing link. Install the trailing link, retainer and bushing on the hanger bracket (Fig. 38). Then install the outer bushing, (gold) outer bushing retainer and nut (Fig. 38) on the trailing link. Using a large adjustable wrench on flat of trailing link to keep it from rotating, tighten the trailing link retaining nut to a torque of 99 N·m (73 ft. lbs.).



**Fig. 38 Trailing Link Bushing Installation**

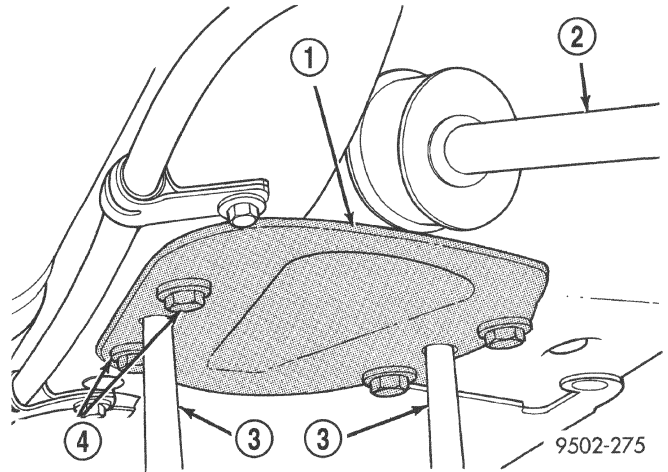
- 1 - INNER TRAILING LINK BUSHING
- 2 - TRAILING LINK
- 3 - INNER TRAILING LINK BUSHING
- 4 - TRAILING LINK INNER BUSHING RETAINER (BLACK)
- 5 - INNER BUSHING RETAINER (BLACK)
- 6 - TRAILING LINK HANGER BRACKET
- 7 - OUTER TRAILING LINK BUSHING
- 8 - NUT
- 9 - OUTER BUSHING RETAINER (GOLD)

(2) Install the (black) inner bushing retainer, and inner bushing (Fig. 38) on the trailing link.

(3) Install knuckle end of trailing link in rear knuckle.

**CAUTION:** It is important that the following procedure be done when installing the trailing arm hanger bracket to the body of the vehicle. This procedure will ensure that the hanger bracket is installed in the correct position on the vehicle.

(4) Install trailing link hanger bracket on vehicle and loosely install the 4 attaching bolts (Fig. 39). Then install 2 drift pins of appropriate size in positioning holes on hanger bracket and into locating holes in body (Fig. 39). With hanger bracket correctly positioned on vehicle tighten the 4 hanger bracket mounting bolts to a torque of 34 N·m (25 ft. lbs.).



**Fig. 39 Trailing Link Hanger Bracket Installation**

- 1 - HANGER BRACKET
- 2 - TRAILING LINK
- 3 - LOCATING DRIFT PINS
- 4 - ATTACHING BOLTS 4

**CAUTION:** When installing trailing link bushing retainers, the retainers must be installed with cupped side of retainer facing away from bushing and knuckle (Fig. 35).

(5) At the knuckle, install the outer trailing link bushing, (gold) outer bushing retainer and retaining nut on trailing link (Fig. 35). Using a large adjustable wrench on flat of trailing link to keep it from rotating tighten the trailing link retaining nut (Fig. 35) to a torque of 99 N·m (73 ft. lbs.).

## STABILIZER BAR (REAR)

### REMOVAL

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove both rear wheel and tire assemblies from the vehicle.

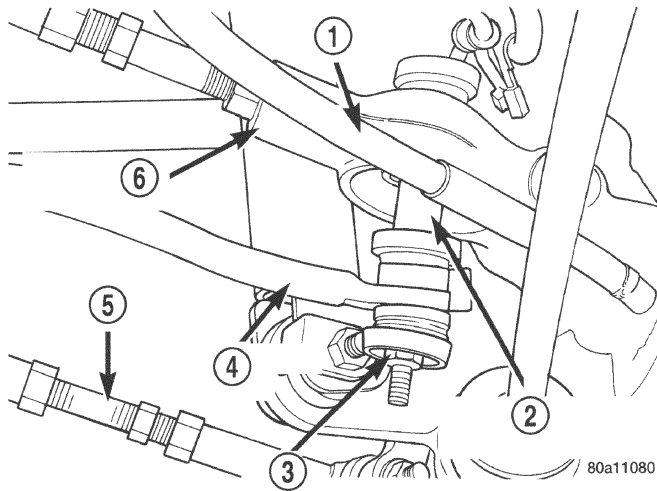
(3) From each side of the vehicle, remove the nut (Fig. 40) attaching the stabilizer bar attaching link/isolator bushings to the stabilizer bar.

(4) Remove the 4 bolts attaching the stabilizer bar bushing clamps to the rear suspension crossmember (Fig. 41).

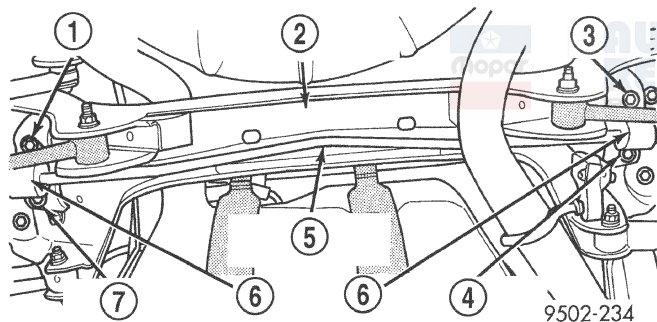
(5) Remove the rear stabilizer bar to crossmember bushing clamps and bushings from the stabilizer bar.

(6) Remove stabilizer bar from vehicle. Stabilizer bar will come out of vehicle between the exhaust pipe and the rear suspension crossmember.



**REMOVAL AND INSTALLATION (Continued)****Fig. 40 Stabilizer Bar Attaching Link**

- 1 - PARK BRAKE CABLE
- 2 - STABILIZER BAR ATTACHING LINK
- 3 - NUT
- 4 - STABILIZER BAR
- 5 - REAR LATERAL LINK
- 6 - FORWARD LATERAL LINK

**Fig. 41 Stabilizer Bar Attachment To Rear Suspension**

- 1 - ATTACHING BOLT
- 2 - REAR SUSPENSION CROSSMEMBER
- 3 - ATTACHING BOLT
- 4 - ATTACHING BOLT
- 5 - REAR STABILIZER BAR
- 6 - STABILIZER BAR ATTACHING BRACKETS
- 7 - ATTACHING BOLT

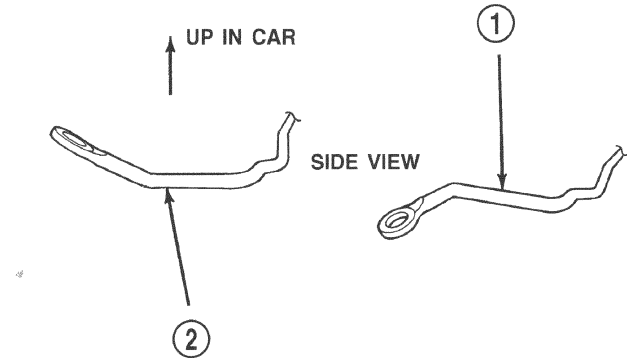
**STABILIZER BAR BUSHING INSPECTION**

Inspect for broken or distorted retainers and bushings. If bushing replacement is required, bushings can be removed by opening slit in bushing and removing bushing from around stabilizer bar.

**INSTALLATION**

(1) Install stabilizer bar back in vehicle with the bushings removed using the reverse sequence of removal.

(2) When stabilizer bar is installed in vehicle, it must be installed with the bend in the end of the stabilizer bar positioned up in vehicle when viewed from the side (Fig. 42).



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**Fig. 42 Installed Position Of Stabilizer Bar In Vehicle**

- 1 - INCORRECTLY INSTALLED POSITION OF STABILIZER BAR
- 2 - CORRECTLY INSTALLED POSITION OF STABILIZER BAR

(3) Install the stabilizer bar onto the stabilizer bar to forward lateral link attaching links (Fig. 40). Install the stabilizer bar to attaching link bushings on attaching links. Tighten the bushing retaining nuts to a torque of 35 N·m (26 ft. lbs.).

(4) Loosely install the stabilizer bar bushing clamps on the rear suspension crossmember

(5) Position the stabilizer bar so it is centered in the vehicle and does not contact other suspension components or vehicle body.

(6) Tighten the bolts attaching the stabilizer bar bushing clamps to the rear crossmember to a torque of 27 N·m (19 ft. lbs.) (Fig. 41).

(7) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(8) Lower vehicle to the ground.

**DISASSEMBLY AND ASSEMBLY****SHOCK ASSEMBLY (REAR)**

The shock assembly must be removed from the vehicle for it to be disassembled and assembled. Refer to REMOVAL AND INSTALLATION in this section for the required procedure.

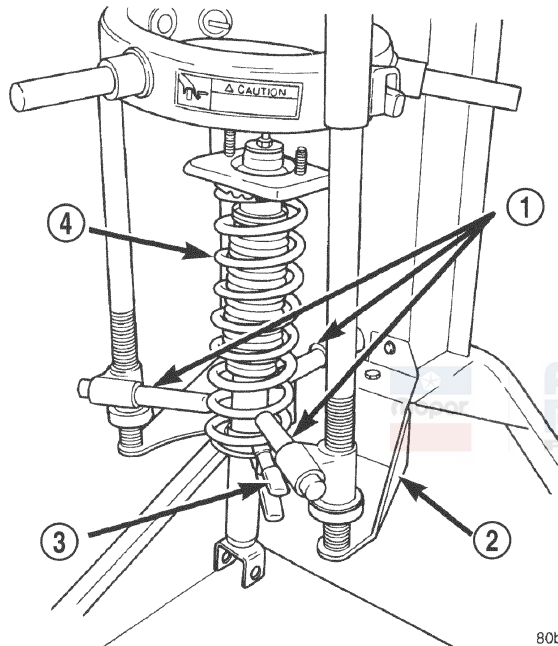
For the disassembly and assembly of the shock assembly, use strut spring compressor Pentastar Service Equipment (PSE) tool W-7200, or the equivalent, to compress the coil spring. Follow the manufacturer's instructions closely.

## DISASSEMBLY AND ASSEMBLY (Continued)

### DISASSEMBLY

(1) If both shocks are being serviced at the same time, mark the coil spring and shock assembly according to which side of the vehicle the shock was removed from, and which shock the coil spring was removed from.

(2) Position the shock assembly in the strut coil spring compressor following the manufacturer's instructions. Set the lower hooks and install the clamp on the lower end of the coil spring, so the shock is held in place once the shock shaft nut is removed (Fig. 43). Lower the upper hooks and position them on the coil spring near the top (Fig. 44).



**Fig. 43 Lower Hooks And Clamp**

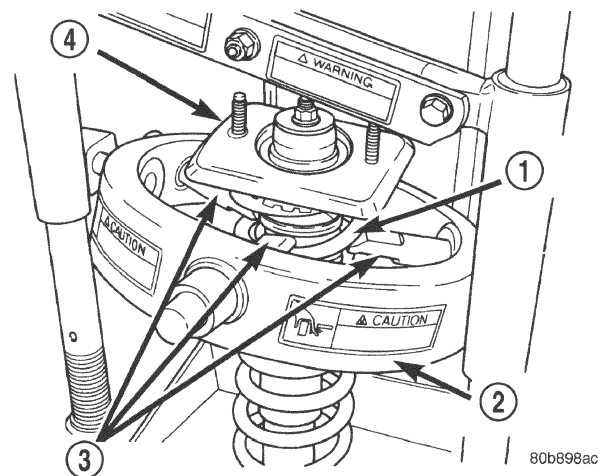
- 1 - LOWER HOOKS
- 2 - STRUT SPRING COMPRESSOR
- 3 - CLAMP
- 4 - COIL SPRING

**WARNING: DO NOT REMOVE THE SHOCK ROD NUT BEFORE THE COIL SPRING IS COMPRESSED. THE COIL SPRING IS HELD UNDER PRESSURE AND MUST BE COMPRESSED, REMOVING SPRING TENSION FROM THE UPPER MOUNTING BRACKET BEFORE THE ROD NUT IS REMOVED.**

(3) Compress the coil spring until all coil spring tension is removed from the upper mounting bracket.

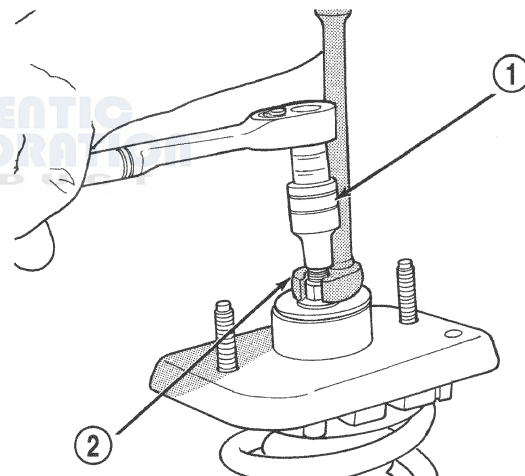
(4) Hold the shock rod from rotating using special socket Snap-On A136, or an equivalent, and remove the retainer nut (Fig. 45).

(5) Remove the upper shock rod bushing retainer washer from the shock rod.



**Fig. 44 Upper Hooks Positioned**

- 1 - COIL SPRING
- 2 - SPRING COMPRESSOR
- 3 - UPPER HOOKS
- 4 - UPPER MOUNT



**Fig. 45 Retainer Nut Removal/Installation**

- 1 - SHOCK ABSORBER SOCKET SNAP-ON A136
- 2 - CROW FOOT

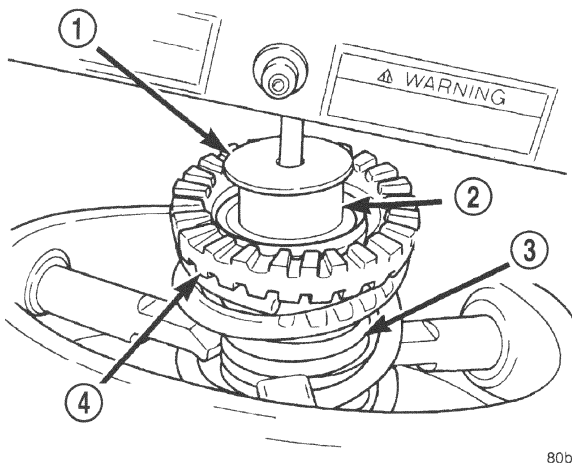
(6) Remove the upper shock mount and the rod isolator bushings as an assembly from the rod of the shock absorber.

(7) Remove the upper coil spring isolator from the top of the coil spring (Fig. 46).

(8) Remove the lower shock rod bushing washer from the top of the dust boot and shock absorber rod (Fig. 46).

(9) Remove the dust shield and cup as an assembly from the shock absorber rod by pulling both straight up and off the shock rod (Fig. 46).

(10) Remove the clamp from the bottom of the coil spring and remove the shock absorber, lower spring

**DISASSEMBLY AND ASSEMBLY (Continued)**

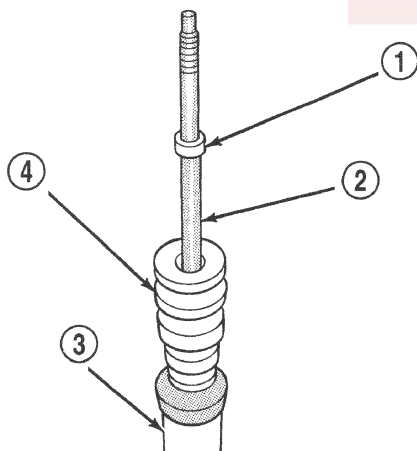
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**Fig. 46 Upper Coil Spring Isolator, Washer And Dust Boot**

- 1 - WASHER
- 2 - CUP
- 3 - DUST SHIELD
- 4 - UPPER COIL SPRING ISOLATOR

isolator, jounce bumper, and collar out through the bottom of the coil spring.

(11) Remove the jounce bumper and the collar (Fig. 47) from the rod of the shock absorber.



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**Fig. 47 Shock Absorber Jounce Bumper And Collar**

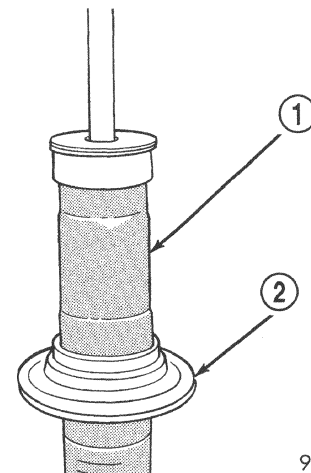
- 1 - COLLAR
- 2 - SHOCK ABSORBER ROD
- 3 - SHOCK ABSORBER
- 4 - JOUNCE BUMPER

(12) Remove the lower coil spring isolator (Fig. 48) from the lower spring seat on the shock absorber.

(13) Remove the upper shock rod isolator bushing and sleeve from the upper shock mount (Fig. 49).

(14) Remove the lower shock rod isolator bushing from the upper shock mount (Fig. 50).

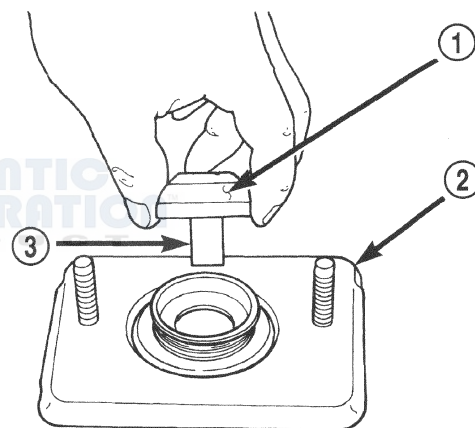
(15) Inspect the shock assembly components for the following and replace as necessary:



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**Fig. 48 Lower Coil Spring Isolator**

- 1 - SHOCK ABSORBER
- 2 - COIL SPRING ISOLATOR



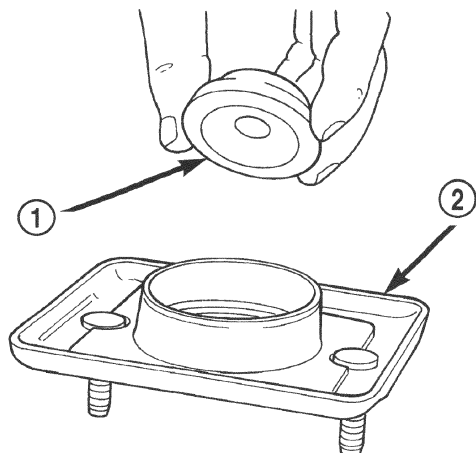
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**Fig. 49 Shock Rod Upper Isolator Bushing**

- 1 - UPPER BUSHING
- 2 - REAR SHOCK ABSORBER MOUNT
- 3 - SLEEVE

- Inspect the shock for any condition of rod binding over the full stroke of the shaft.
- Check the upper shock mount for cracks and distortion, and locating studs for any sign of damage.
- Check the upper and lower shock rod isolator bushings for severe deterioration of the rubber.
- Check the upper and lower coil spring isolators for severe deterioration of the rubber.
- Inspect the dust shield for rips and deterioration.
- Inspect the jounce bumper for cracks and signs of deterioration.
- Inspect the coil spring for any sign of damage to the coating.



**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 50 Shock Rod Lower Isolator Bushing**

- 1 - LOWER BUSHING  
2 - REAR SHOCK ABSORBER MOUNT

(16) If the coil spring needs to be serviced, release the tension from the coil spring by backing off the compressor drive fully. Push back the compressor upper hooks and remove the coil spring from the compressor.

**ASSEMBLY**

(1) If the coil spring has been removed from the compressor, place the lower end (smaller diameter) of the coil spring in the spring compressor supported by the lower hooks at the same position as in disassembly (Fig. 43), following the manufacturer's instructions.

(2) Position the upper hooks of the spring compressor on the coil spring near the top as in disassembly (Fig. 44).

(3) Compress the coil spring enough to reinstall the shock absorber and upper mount.

(4) Install the lower shock rod isolator bushing in the bottom of the upper shock mount (Fig. 50). The smaller end is to be pointed away from the mount.

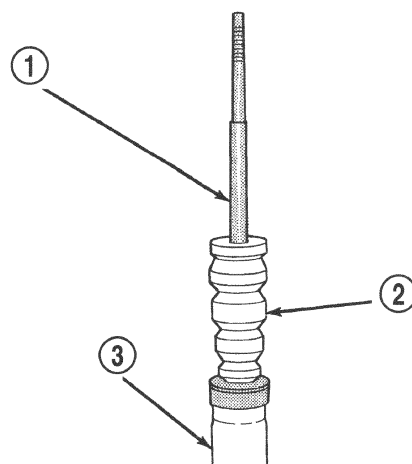
(5) Install the upper shock rod isolator bushing and sleeve in the upper shock mount until seated into lower bushing (Fig. 49). The smaller end of the bushing is to be pointed away from the mount when installed.

(6) Install the lower coil spring isolator (Fig. 48) on the lower spring seat of the shock absorber.

(7) Install the jounce bumper as shown on the rod of the shock absorber (Fig. 51).

(8) Install the collar on the rod of the shock absorber assembly with the undercut side of sleeve facing down (Fig. 52). Push the collar down until seated on the step of the shock absorber rod.

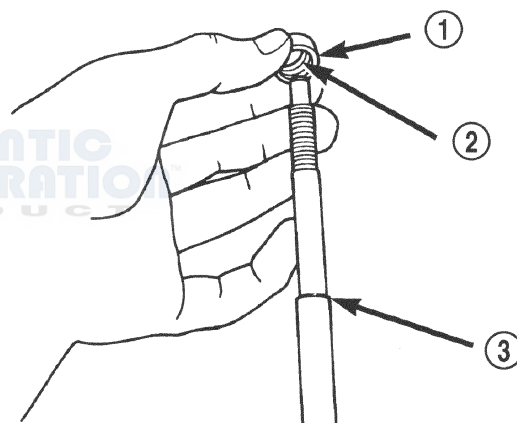
(9) Install the shock through the bottom of the coil spring until the lower spring seat contacts the lower



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**Fig. 51 Jounce Bumper Installed**

- 1 - SHOCK ABSORBER ROD  
2 - SHOCK ABSORBER JOUNCE BUMPER  
3 - SHOCK ABSORBER



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**Fig. 52 Installing Collar On Shock Absorber Rod**

- 1 - COLLAR  
2 - UNDERCUT  
3 - SHOCK ABSORBER ROD STEP

end of the coil spring. Install the clamp temporarily securing the shock absorber to the coil spring (Fig. 44).

(10) Install dust shield and cup over the jounce bumper and onto the rod of the shock absorber.

(11) Install the lower shock rod bushing retainer washer on the shock absorber rod.

(12) Install the upper spring isolator on the top of the coil spring. The bottom of the isolator is contoured to fit around the inside diameter of the coil spring (Fig. 46).

(13) Install the upper shock mount bracket and rod isolator bushings as an assembly on the top of the rod of the shock absorber (Fig. 44).

**DISASSEMBLY AND ASSEMBLY (Continued)**

(14) Install the upper shock rod bushing retainer washer. Make sure the concave side is facing up.

(15) Install the shock assembly retainer nut. Hold the shock rod from rotating using special socket Snap-On A136, or an equivalent, and tighten the retainer nut using a crow foot wrench (on the end of a torque wrench and extension) to a torque of 55 N·m (40 ft. lbs.) (Fig. 45).

(16) Position the upper shock mount so its studs are in line with the bolt hole in the shock absorber lower bracket (Fig. 44).

(17) Slowly release the tension from the coil spring by backing off the compressor drive fully. As the tension is relieved, make sure the upper mount, isolator, and coil spring align properly. Remove the clamp from the lower end of the coil spring and shock. Push back the spring compressor upper and lower hooks, then remove the shock assembly from the spring compressor.

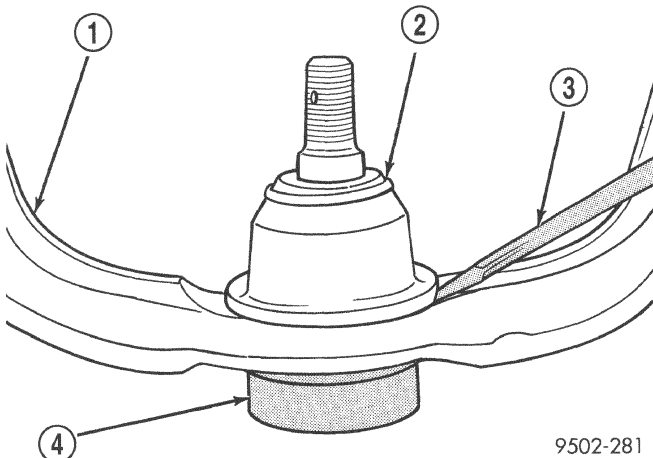
(18) Install shock assembly on the vehicle. Refer to REMOVAL AND INSTALLATION in this section for the required procedure.

**BALL JOINT (REAR UPPER)**

The rear upper control arm must be removed from the vehicle for replacement of the ball joint. Refer to CONTROL ARM (REAR UPPER) in the REMOVAL AND INSTALLATION section of this service manual group for the required procedure.

**REMOVAL**

(1) Using a screw driver or other suitable tool, pry seal boot up and off of ball joint assembly (Fig. 53).

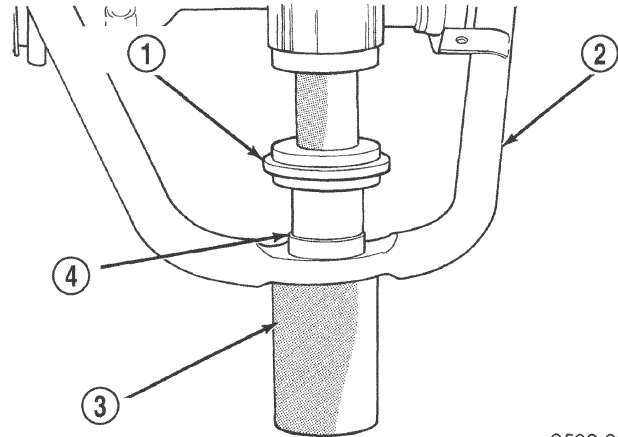


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**Fig. 53 Ball Joint Seal Boot Removal**

- 1 - UPPER CONTROL ARM
- 2 - BALL JOINT SEAL
- 3 - SCREWDRIVER
- 4 - BALL JOINT

(2) Position Receiving Cup, Special Tool 6758 to support control arm when removing ball joint assembly (Fig. 54). Install Remover/Installer, Special Tool 6804 on top of ball joint assembly (Fig. 54).



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**Fig. 54 Removing Ball Joint From Upper Control Arm**

- 1 - SPECIAL TOOL 6804
- 2 - CONTROL ARM
- 3 - SPECIAL TOOL 6758
- 4 - BALL JOINT

(3) Using an arbor press, press the ball joint assembly out of the control arm.

**INSTALLATION**

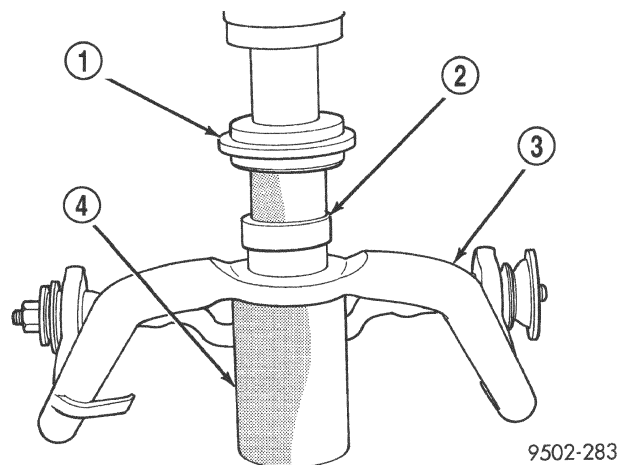
(1) By hand, position ball joint assembly into ball joint bore of control arm. Be sure ball joint assembly is not cocked in the bore of the control arm, this will cause binding of the ball joint assembly, when being pressed into lower control arm.

(2) Position assembly in an arbor press with Receiving Cup, Special Tool 6758 supporting lower control arm (Fig. 55). Then install Remover/Installer, Special Tool 6804 on the top of the ball joint assembly (Fig. 55).

**CAUTION:** When installing the ball joint in the upper control arm, do not press the ball joint into the control arm all the way. The lip on the ball joint must not touch the surface of the control arm. Refer to Step 3 below when installing the ball joint.

(3) Carefully align all pieces. Using the arbor press, press the ball joint into the control arm until a gap of 3mm (1/8 inch) is between lip on ball joint and surface of lower control arm.

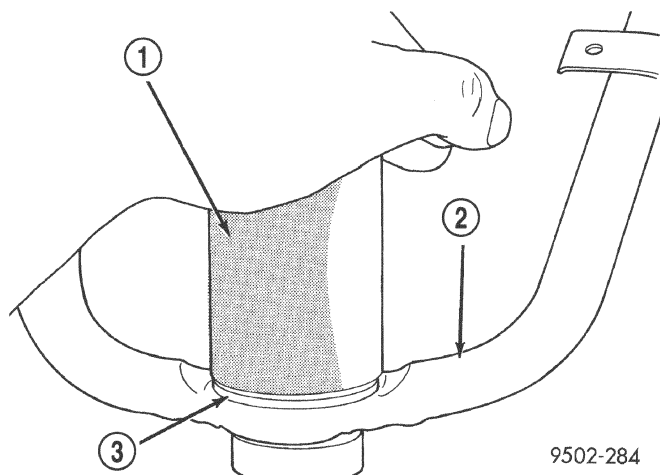
(4) Install a **NEW** ball joint assembly sealing boot on ball joint assembly.

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 55 Installing Ball Joint In Upper Control Arm**

- 1 - SPECIAL TOOL 6804  
 2 - BALL JOINT  
 3 - CONTROL ARM  
 4 - SPECIAL TOOL 6758

**CAUTION:** Do not use an arbor press to install the sealing boot on the lower control arm ball joint assembly. Damage to the sealing boot can occur due to excessive pressure applied to sealing boot when being installed.

(5) Position Receiving Cup, Special Tool 6758 over sealing boot so it is aligned properly with bottom edge of sealing boot (Fig. 56). Apply pressure **BY HAND** to special tool 6758, until sealing boot is pressed squarely against surface of control arm.

**Fig. 56 Ball Joint Seal Boot Installation**

- 1 - SPECIAL TOOL 6758  
 2 - CONTROL ARM  
 3 - BALL JOINT SEAL

(6) Reinstall the control arm on the vehicle. Refer to **CONTROL ARM (REAR UPPER)** in the **REMOVAL AND INSTALLATION** section of this service manual group for the required procedure.

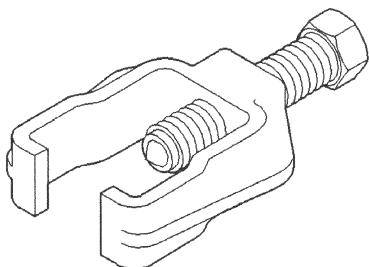
**SPECIFICATIONS****REAR SUSPENSION FASTENER TORQUE SPECIFICATIONS**

DESCRIPTION	TORQUE
<b>Shock Assembly:</b>	
Body Mounting Nuts . . . . .	54 N·m (40 ft. lbs.)
Knuckle Bolt/Nut . . . . .	95 N·m (70 ft. lbs.)
Rod To Upper Mount Nut . . . . .	55 N·m (40 ft. lbs.)
<b>Knuckle:</b>	
Brake Support Plate Mounting Bolts . . . . .	61 N·m (45 ft. lbs.)
<b>Hub And Bearing:</b>	
Knuckle Retaining Nut . . . . .	250 N·m (185 ft. lbs.)
Wheel Stud Mounting Nuts . . . . .	109-150 N·m (80-110 ft. lbs.)
<b>Upper Control Arm:</b>	
Pivot Bar To Crossmember . . . . .	107 N·m (80 ft. lbs.)
<b>Lateral Links:</b>	
To Knuckle Nuts . . . . .	108 N·m (80 ft. lbs.)
Jam Nuts . . . . .	92 N·m (68 ft. lbs.)
To Suspension Crossmember Nuts . . . . .	108 N·m (80 ft. lbs.)
<b>Trailing Link:</b>	
Shaft Nuts (Front And Rear) . . . . .	99 N·m (73 ft. lbs.)
Bracket To Body Mounting Bolts . . . . .	34 N·m (25 ft. lbs.)
<b>Ball Joint:</b>	
To Knuckle Castle Nut . . . . .	85 N·m (63 ft. lbs.)
<b>Rear Suspension Crossmember:</b>	
Body Attaching Bolts . . . . .	108 N·m (80 ft. lbs.)
<b>Stabilizer Bar:</b>	
Isolator Bushing Retainer Bolt . . . . .	28 N·m (20 ft. lbs.)
Lateral Link Attaching Link Nut . . . . .	35 N·m (26 ft. lbs.)
Bracket To Crossmember Bolts . . . . .	28 N·m (20 ft. lbs.)

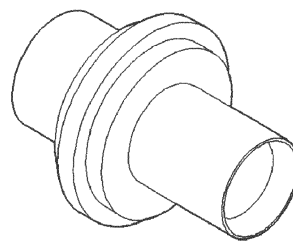


## SPECIAL TOOLS

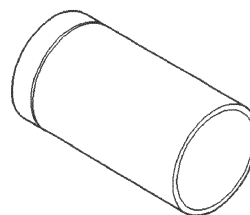
### REAR SUSPENSION



*Puller, Pitman Arm CT-1106*



*Remover, Suspension Arm Bushing And Ball Joint  
6804*



*Installer, Ball Joint 6758*



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# DIFFERENTIAL AND DRIVELINE

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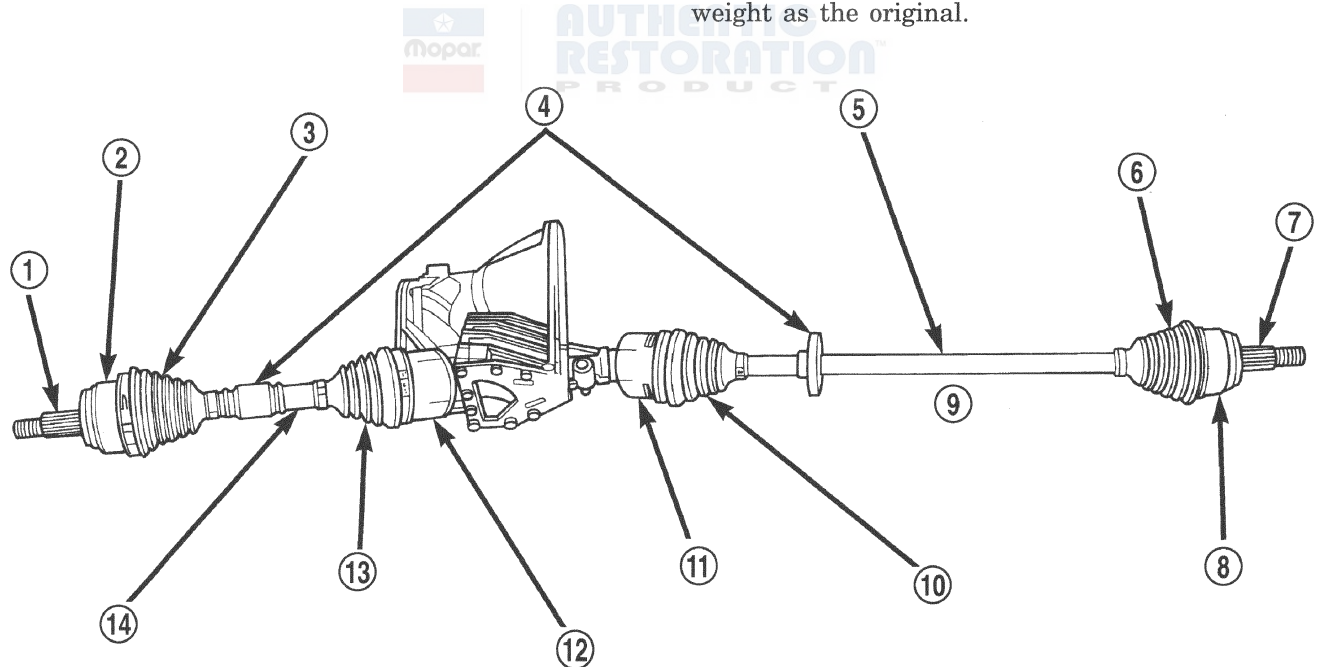
## DESCRIPTION AND OPERATION

### FRONT DRIVESHAFTS

Vehicles equipped with either an automatic or manual transmission uses an unequal length driveshaft system (Fig. 1).

Vehicles equipped with automatic transaxles use a solid short interconnecting shaft on the left side. The right side of the vehicle uses a longer solid interconnecting shaft.

The left driveshaft uses a tuned rubber damper weight. When replacing the left driveshaft, be sure the replacement driveshaft has the same damper weight as the original.



**Fig. 1 Unequal Length Driveshaft System**

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- |                                |  |
|--------------------------------|--|
| 1 - STUB AXLE                  | 8 - OUTER C/V JOINT                        |
| 2 - OUTER C/V JOINT            | 9 - RIGHT DRIVESHAFT                       |
| 3 - OUTER C/V JOINT BOOT       | 10 - INNER TRIPOD JOINT BOOT               |
| 4 - TUNED RUBBER DAMPER WEIGHT | 11 - INNER TRIPOD JOINT                    |
| 5 - INTERCONNECTING SHAFT      | 12 - INNER TRIPOD JOINT                    |
| 6 - OUTER C/V JOINT BOOT       | 13 - INNER TRIPOD JOINT BOOT               |
| 7 - STUB AXLE                  | 14 - INTERCONNECTING SHAFT LEFT DRIVESHAFT |

**DESCRIPTION AND OPERATION (Continued)**

Both driveshaft assemblies use the same type of inner and outer joints. The inner joint of both driveshaft assemblies is a tripod joint, and the outer joint of both driveshaft assemblies is a Rzeppa joint. Both tripod joints and Rzeppa joints are true constant velocity (C/V) joint assemblies. The inner tripod joint allows for the changes in driveshaft length through the jounce and rebound travel of the front suspension.

On vehicles equipped with ABS brakes, the outer C/V joint is equipped with a tone wheel used to determine vehicle speed for ABS brake operation.

The inner tripod joint of both driveshafts is splined into the transaxle side gears. The inner tripod joints are retained in the side gears of the transaxle using a snap ring located in the stub shaft of the tripod joint. The outer C/V joint has a stub shaft that is splined into the wheel hub and retained by a steel hub nut.

**NOTE:** This vehicle does not use a rubber lip bearing seal as on past front wheel drive cars, to prevent contamination of the front wheel bearing. It is important though to thoroughly clean the outer C/V joint and the wheel bearing area in the steering knuckle before it is assembled after servicing.

**DIAGNOSIS AND TESTING****DRIVESHAFT DIAGNOSIS****VEHICLE INSPECTION**

(1) Check for grease in the vicinity of the inboard tripod joint and outboard C/V joint; this is a sign of inner or outer joint seal boot or seal boot clamp damage.

(2) A light film of grease may appear on the right inner tripod joint seal boot; this is considered normal and should not require replacement of the seal boot.

**NOISE AND/OR VIBRATION IN TURNS**

A clicking noise and/or a vibration in turns could be caused by one of the following conditions:

(1) Damaged outer C/V or inner tripod joint seal boot or seal boot clamps. This will result in the loss and/or contamination of the joint grease, resulting in inadequate lubrication of the joint.

(2) Noise may also be caused by another component of the vehicle coming in contact with the driveshafts.

**CLUNKING NOISE DURING ACCELERATION**

This noise may be a result of one of the following conditions:

(1) A torn seal boot on the inner or outer joint of the driveshaft assembly.

(2) A loose or missing clamp on the inner or outer joint of the driveshaft assembly.

(3) A damaged or worn driveshaft C/V joint.

**SHUDDER OR VIBRATION DURING ACCELERATION**

This problem could be a result of:

(1) A worn or damaged driveshaft inner tripod joint.

(2) A sticking tripod joint spider assembly (inner tripod joint only).

(3) Improper wheel alignment. See Wheel Alignment in this group for alignment checking and setting procedures and specifications.

**VIBRATION AT HIGHWAY SPEEDS**

This problem could be a result of:

(1) Foreign material (mud, etc.) packed on the backside of the wheel(s).

(2) Out of balance front tires or wheels. See Group 22, Wheels And Tires for the required balancing procedure.

(3) Improper tire and/or wheel runout. See Group 22, Wheels And Tires for the required runout checking procedure.

**REMOVAL AND INSTALLATION****FRONT DRIVESHAFTS****REMOVAL**

(1) Loosen (but do not remove) stub axle to hub/bearing retaining nut. Loosen hub nut while vehicle is on the floor with the brakes applied (Fig. 2). The front hub and driveshaft are splined together and retained by the hub nut.

(2) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting, in the Lubrication and Maintenance section, for required lifting procedure to be used for this vehicle.

(3) Remove front tire and wheel assembly from the hub.

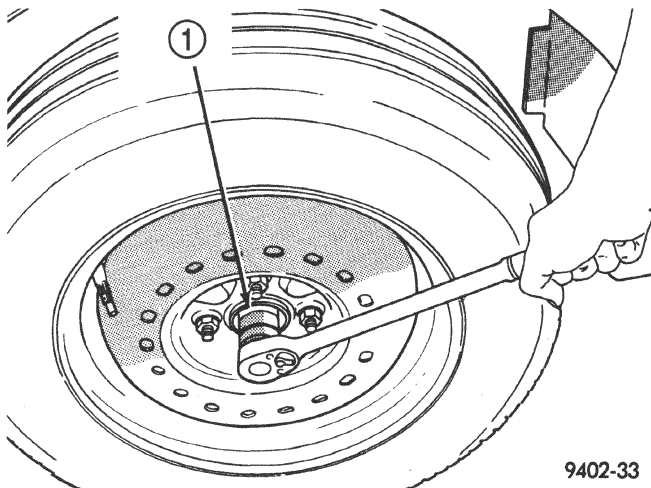
(4) Remove the driveshaft-to-hub and bearing retaining nut (Fig. 3).

(5) Remove front disc brake caliper assembly to steering knuckle guide pin attaching bolts (Fig. 4).

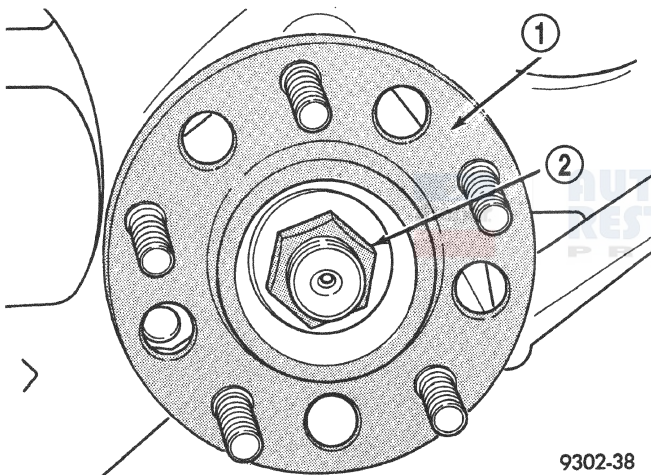
(6) Remove disc brake caliper assembly from steering knuckle. Caliper is removed by first lifting bottom of caliper away from steering knuckle, and then removing top of caliper out from under steering knuckle (Fig. 5).



## REMOVAL AND INSTALLATION (Continued)

**Fig. 2 Loosening Front Hub Retaining Nut**

1 - FRONT HUB

**Fig. 3 Driveshaft Retaining Nut—Typical**

1 - HUB/BEARING ASSEMBLY

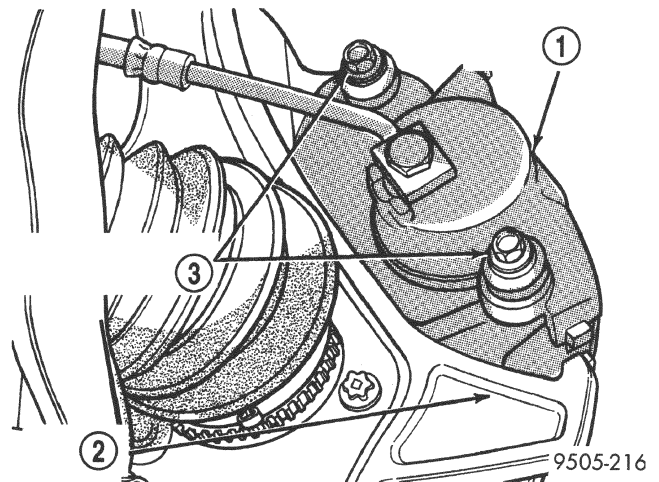
2 - NUT

(7) Support brake caliper/adaptor assembly using a wire hook (Fig. 6). **Do not support assembly by the brake flex hose.**

(8) Remove braking disc from front hub (Fig. 5).

(9) Remove nut attaching outer tie rod end to steering knuckle. **Remove nut from tie rod end by holding tie rod end stud with a 11/32 socket and loosen and remove nut (Fig. 7).**

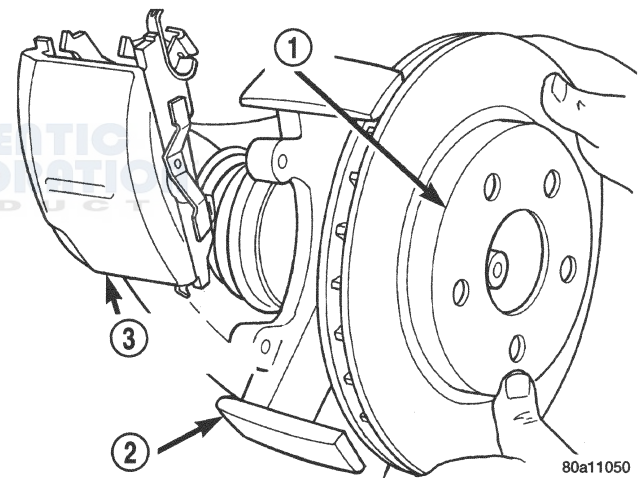
(10) Remove the tie rod end stud from steering knuckle arm, using remover, Special Tool MB-991113 (Fig. 8).

**Fig. 4 Caliper Guide Pin Attaching Bolts**

1 - DISC BRAKE CALIPER ASSEMBLY

2 - STEERING KNUCKLE

3 - CALIPER ASSEMBLY GUIDE PIN BOLTS

**Fig. 5 Removing Disc Brake Caliper and Rotor**

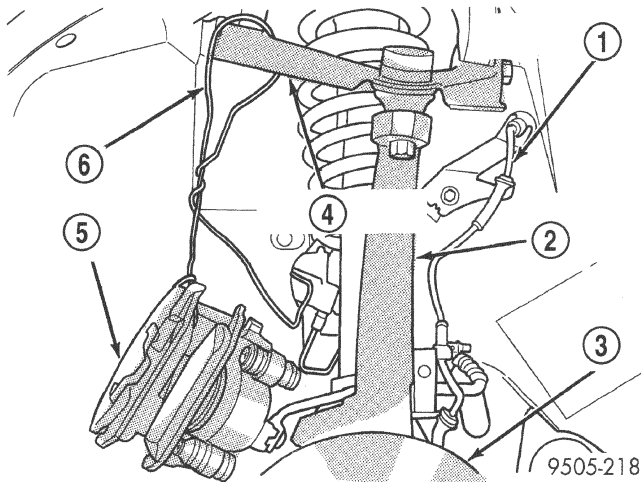
1 - BRAKING DISC

2 - STEERING KNUCKLE

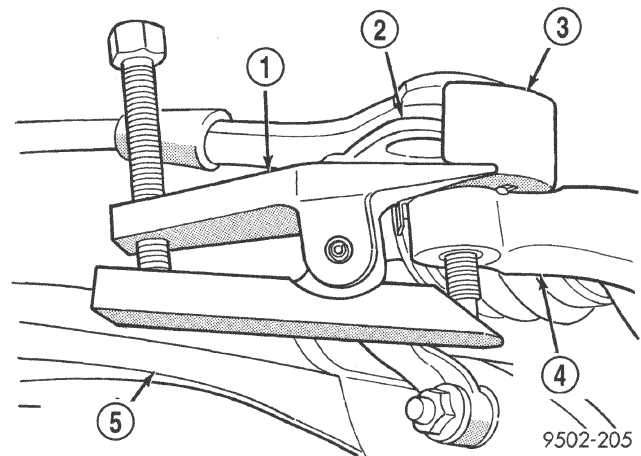
3 - DISC BRAKE CALIPER ASSEMBLY (STORED)

(11) If equipped with antilock brakes, remove the speed sensor cable routing bracket from the steering knuckle (Fig. 9).

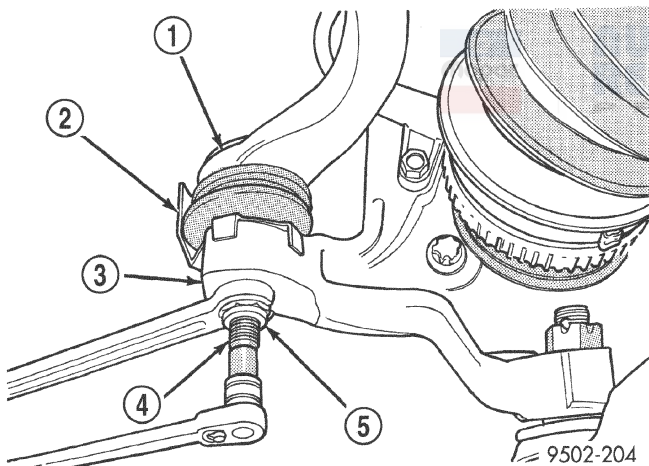
(12) Remove cotter pin and castle nut (Fig. 10) from stud of lower ball joint at the steering knuckle.

**REMOVAL AND INSTALLATION (Continued)****Fig. 6 Correctly Supported Brake Caliper**

- 1 - ABS SPEED SENSOR CABLE
- 2 - STEERING KNUCKLE
- 3 - ROTOR
- 4 - UPPER CONTROL ARM
- 5 - DISC BRAKE CALIPER ASSEMBLY
- 6 - WIRE HANGER

**Fig. 8 Tie Rod End Removal from Steering Knuckle**

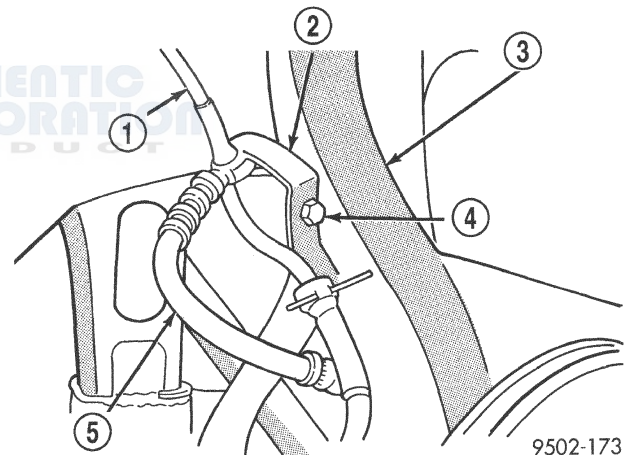
- 1 - SPECIAL TOOL MB-991113
- 2 - TIE ROD END
- 3 - HEAT SHIELD
- 4 - STEERING KNUCKLE
- 5 - LOWER CONTROL ARM

**Fig. 7 Removing Tie Rod End Attaching Nut**

- 1 - TIE ROD END
- 2 - HEAT SHIELD
- 3 - STEERING KNUCKLE
- 4 - TIE ROD END STUD
- 5 - NUT

**CAUTION:** No tool is to be inserted between the steering knuckle and the lower ball joint to separate stud of lower ball joint from the steering knuckle. The steering knuckle is to be separated from the stud of the ball joint only using the procedure as described in Step 13.

(13) Turn steering knuckle so the front of the steering knuckle is facing as far outboard in the

**Fig. 9 Wheel Speed Sensor Cable Routing Bracket**

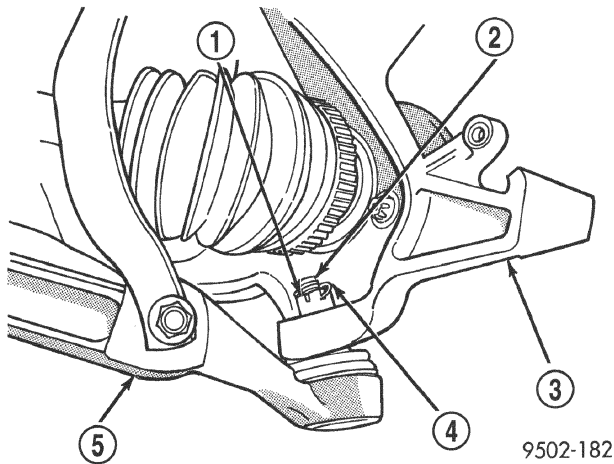
- 1 - WHEEL SPEED SENSOR CABLE
- 2 - SPEED SENSOR CABLE ROUTING BRACKET
- 3 - STEERING KNUCKLE
- 4 - ATTACHING BOLT
- 5 - BRAKE CALIPER FLEX HOSE

wheel well as possible. Using a hammer strike steering knuckle boss until steering knuckle separates from stud of lower ball joint (Fig. 11). **When striking steering knuckle, care MUST be taken not to hit lower control arm or ball joint grease seal.**

**NOTE:** Care must be taken not to separate the inner C/V joint during this operation. Do not allow driveshaft to hang by inner C/V joint. Driveshaft must be supported.

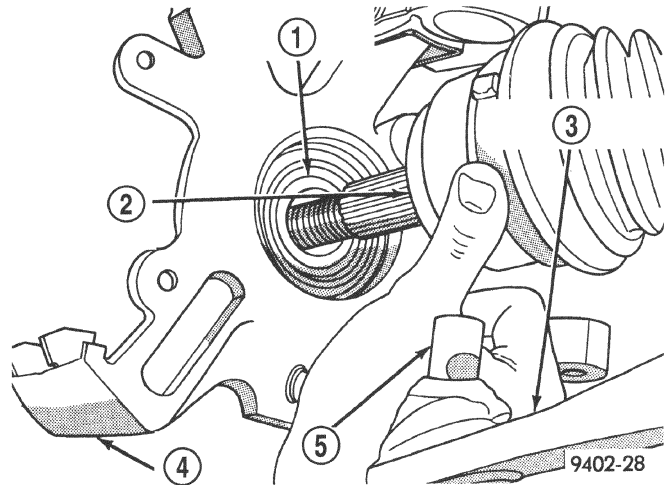


## REMOVAL AND INSTALLATION (Continued)



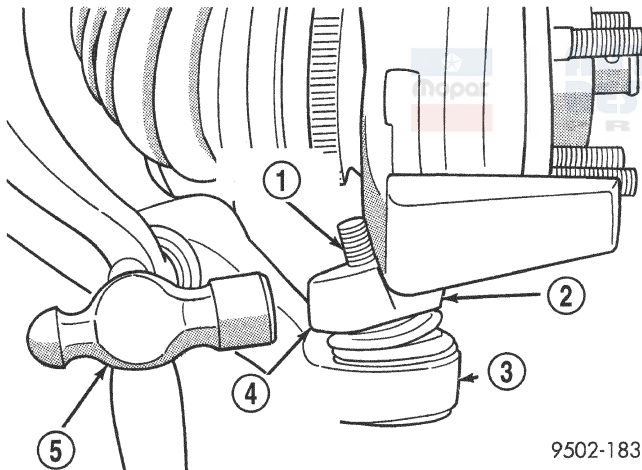
**Fig. 10 Lower Ball Joint to Steering Knuckle Attachment**

- 1 - CASTLE NUT
- 2 - BALL JOINT STUD
- 3 - STEERING KNUCKLE
- 4 - COTTER PIN
- 5 - LOWER CONTROL ARM



**Fig. 12 Separating Steering Knuckle from Outer C/V Joint**

- 1 - HUB/BEARING ASSEMBLY
- 2 - DRIVE SHAFT
- 3 - LOWER CONTROL ARM
- 4 - STEERING KNUCKLE
- 5 - BALL JOINT



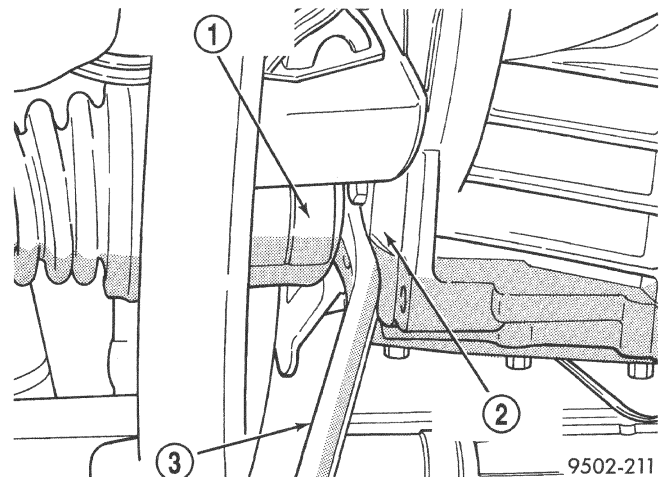
**Fig. 11 Separating Ball Joint Stud from Steering Knuckle**

- 1 - BALL JOINT STUD
- 2 - STEERING KNUCKLE
- 3 - LOWER CONTROL ARM
- 4 - STEERING KNUCKLE BOSS
- 5 - HAMMER

(14) Pull steering knuckle assembly out and away from outer C/V joint of the driveshaft assembly (Fig. 12).

**CAUTION:** When inserting pry bar between inner tripod joint and transaxle case, care must be used to ensure no damage occurs to oil seal in transaxle case.

(15) Support the outer end of the driveshaft assembly. Insert a pry bar between inner tripod joint and transaxle case (Fig. 13). Pry against inner tripod joint, until tripod joint retaining snap ring is disengaged from transaxle side gear.



**Fig. 13 Disengaging Inner Tripod Joint From Transaxle**

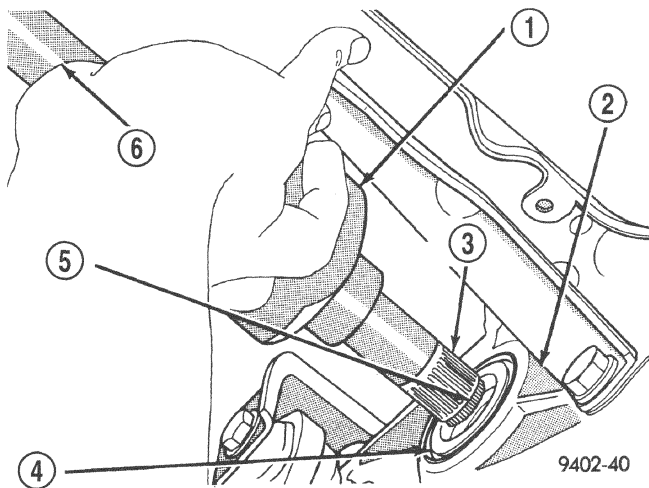
- 1 - INNER TRIPOD JOINT
- 2 - TRANSAXLE CASE
- 3 - PRY BAR

(16) Hold inner tripod joint and interconnecting shaft of driveshaft assembly. Remove inner tripod joint from transaxle, by pulling it straight out of transaxle side gear and transaxle oil seal (Fig. 14).



**REMOVAL AND INSTALLATION (Continued)**

When removing tripod joint, do not let spline or snap ring drag across sealing lip of the transaxle to tripod joint oil seal.



**Fig. 14 Tripod Joint Removal from Transaxle**

- 1 - INNER TRIPOD JOINT
- 2 - TRANSAXLE
- 3 - SPLINE
- 4 - OIL SEAL
- 5 - SNAP RING
- 6 - INTERCONNECTING SHAFT

**INSTALLATION**

(1) Thoroughly clean spline and oil seal sealing surface, on tripod joint. Lightly lubricate oil seal sealing surface on tripod joint with fresh clean transmission lubricant.

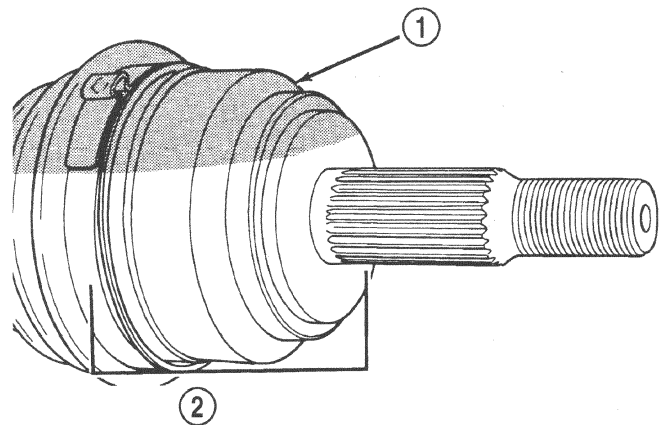
(2) Holding driveshaft assembly by tripod joint and interconnecting shaft, install tripod joint into transaxle side gear as far as possible by hand (Fig. 14).

(3) Grasp inner tripod joint and interconnecting shaft. Forcefully push the tripod joint into side gear of transaxle, until snap ring is engaged with transaxle side gear. **Test that snap ring is fully engaged with side gear by attempting to remove tripod joint from transaxle by hand. If snap ring is fully engaged with side gear, tripod joint will not be removable by hand.**

(4) Clean all debris and moisture out of steering knuckle, in the area where outer C/V joint will be installed into steering knuckle.

(5) Ensure that front of outer C/V joint which fits against the face of the hub and bearing is free of debris and moisture before installing outer C/V joint into hub and bearing assembly (Fig. 15).

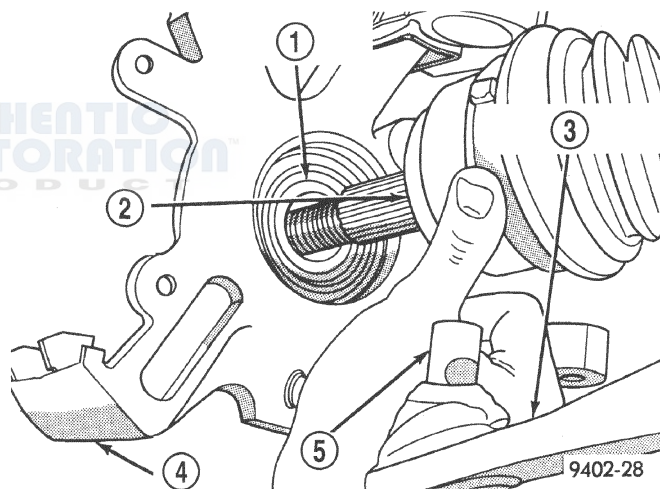
(6) Slide driveshaft back into front hub (Fig. 16). Then install steering knuckle onto the lower control arm ball joint stud.



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**Fig. 15 Outer C/V Joint Inspection**

- 1 - OUTER C/V JOINT
- 2 - THIS AREA OF OUTER C/V JOINT MUST BE FREE OF ALL DEBRIS AND MOISTURE, BEFORE INSTALLATION INTO STEERING KNUCKLE.



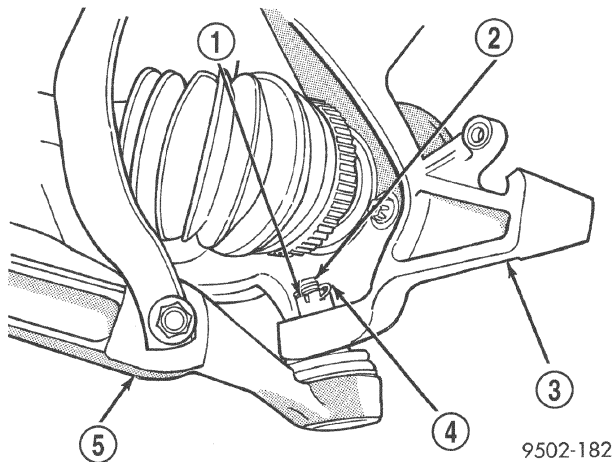
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**Fig. 16 Steering Knuckle Installation on Outer C/V Joint**

- 1 - HUB/BEARING ASSEMBLY
- 2 - DRIVE SHAFT
- 3 - LOWER CONTROL ARM
- 4 - STEERING KNUCKLE
- 5 - BALL JOINT

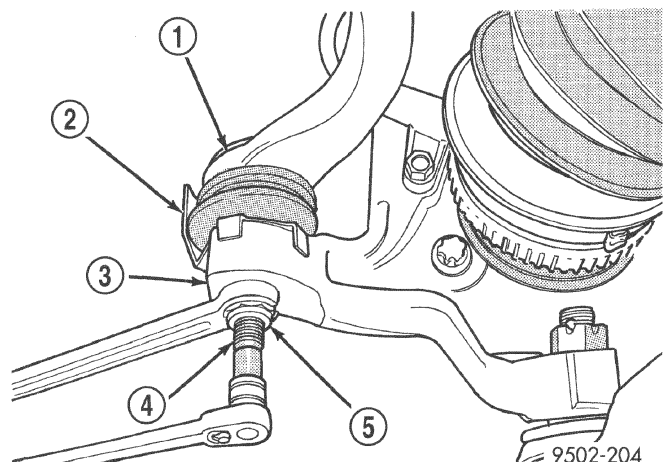
(7) Install the steering knuckle to ball joint stud castle nut (Fig. 17). Tighten the castle nut to 95 N·m (70 ft. lbs.).

(8) If equipped with antilock brakes, install the speed sensor cable on the steering knuckle and securely tighten bolt (Fig. 18).

**REMOVAL AND INSTALLATION (Continued)**

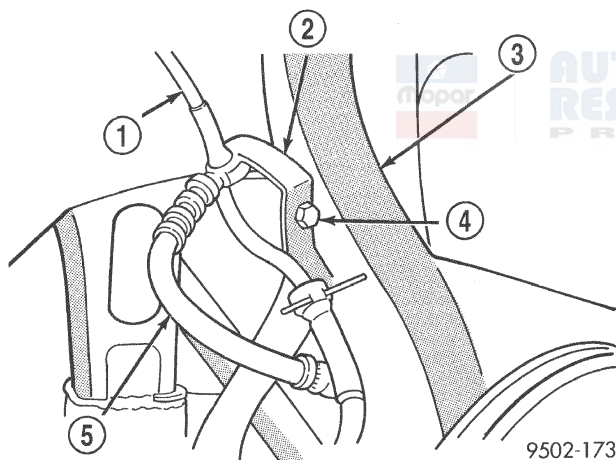
**Fig. 17 Lower Ball Joint to Steering Knuckle Attachment**

- 1 - CASTLE NUT
- 2 - BALL JOINT STUD
- 3 - STEERING KNUCKLE
- 4 - COTTER PIN
- 5 - LOWER CONTROL ARM



**Fig. 19 Installing Tie Rod End Nut**

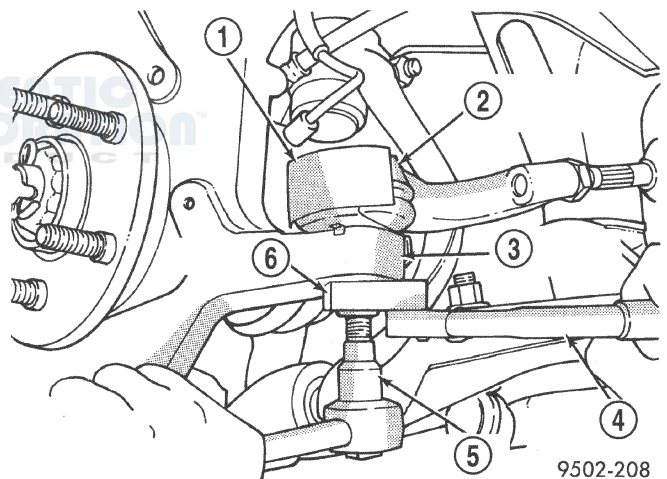
- 1 - TIE ROD END
- 2 - HEAT SHIELD
- 3 - STEERING KNUCKLE
- 4 - TIE ROD END STUD
- 5 - NUT



**Fig. 18 Wheel Speed Sensor Cable Routing Bracket**

- 1 - WHEEL SPEED SENSOR CABLE
- 2 - SPEED SENSOR CABLE ROUTING BRACKET
- 3 - STEERING KNUCKLE
- 4 - ATTACHING BOLT
- 5 - BRAKE CALIPER FLEX HOSE

(9) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle nut onto stud of tie rod end. While holding stud of tie rod end stationary (Fig. 19), tighten tie rod end to steering knuckle nut. Using a crowfoot and 11/32 socket, tighten the nut to 61 N·m (45 ft. lbs.) (Fig. 20).



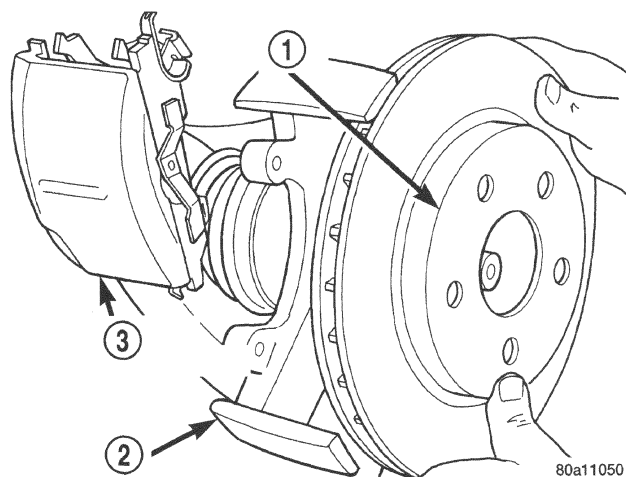
**Fig. 20 Torquing Tie Rod End Nut**

- 1 - HEAT SHIELD
- 2 - TIE ROD END
- 3 - STEERING KNUCKLE
- 4 - TORQUE WRENCH
- 5 - 11/32 SOCKET
- 6 - CROWFOOT

(10) Install braking disc back on hub and bearing assembly.

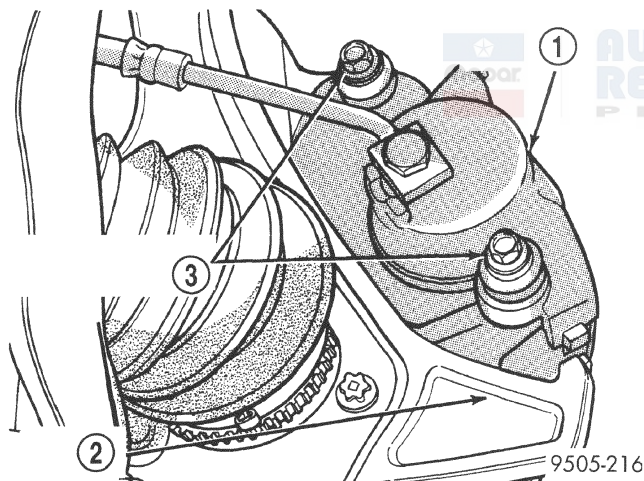
(11) Install disc brake caliper assembly on steering knuckle. Caliper is installed by first sliding top of caliper under top abutment on steering knuckle. Then installing bottom of caliper against bottom abutment of steering knuckle (Fig. 21).



**REMOVAL AND INSTALLATION (Continued)****Fig. 21 Installing Disc Brake Caliper and Rotor**

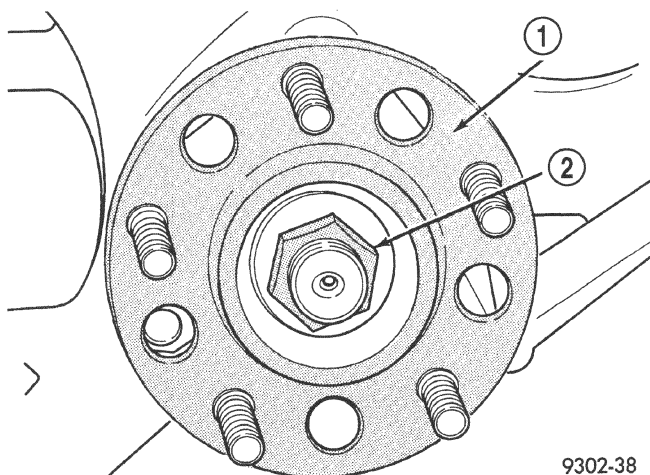
- 1 - BRAKING DISC
- 2 - STEERING KNUCKLE
- 3 - DISC BRAKE CALIPER ASSEMBLY (STORED)

(12) Install caliper assembly to steering knuckle guide pin bolts (Fig. 22). Tighten caliper assembly bolts to 31 N·m (23 ft. lbs.).

**Fig. 22 Disc Brake Caliper Bolts**

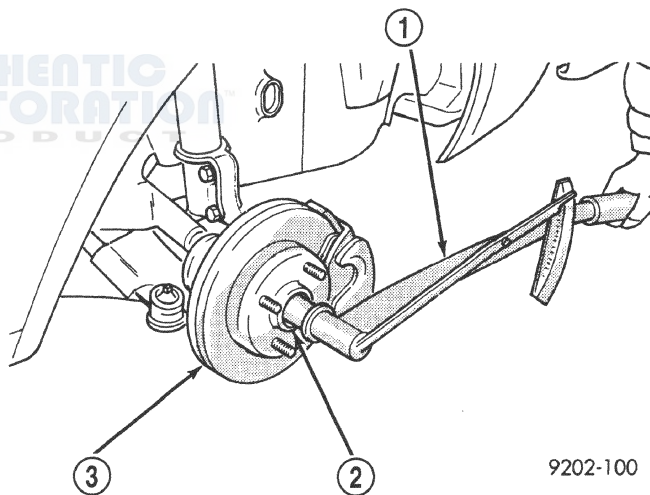
- 1 - DISC BRAKE CALIPER ASSEMBLY
- 2 - STEERING KNUCKLE
- 3 - CALIPER ASSEMBLY GUIDE PIN BOLTS

(13) Clean all foreign matter from the threads of the outer C/V joint stub axle. Install hub nut onto threads of stub axle and tighten nut. (Fig. 23).

**Fig. 23 Driveshaft Retaining Nut—Typical**

- 1 - HUB/BEARING ASSEMBLY
- 2 - NUT

(14) With vehicle brakes applied to keep braking disc from turning, tighten hub nut to 142 N·m (105 ft. lbs.) (Fig. 24).

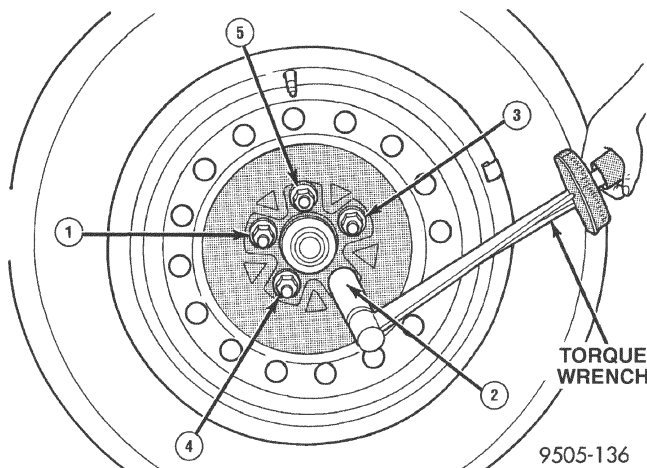
**Fig. 24 Torquing Front Hub Nut**

- 1 - TORQUE WRENCH
- 2 - HUB
- 3 - BRAKING DISC

(15) Install front wheel and tire assembly. Install front wheel lug nuts and tighten in the correct sequence (Fig. 25). Tighten lug nuts to 135 N·m (100 ft. lbs.).



## REMOVAL AND INSTALLATION (Continued)



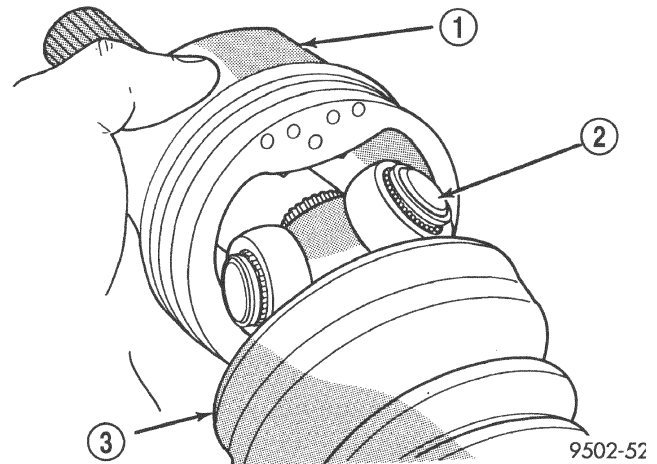
**Fig. 25 Wheel Lug Torquing Sequence**

(16) Lower vehicle.

(17) Check for correct fluid level in transaxle assembly. Refer to Group 21, Transaxle for the correct fluid level checking procedure for the type of transaxle being checked.

(18) Set front toe on vehicle to required specification.

(3) Slide the tripod joint housing off the spider assembly and the interconnecting shaft (Fig. 26).



**Fig. 26 Spider Assembly Removal from Tripod Joint Housing**

- 1 - TRIPOD JOINT HOUSING
- 2 - SPIDER ASSEMBLY
- 3 - SEALING BOOT

## DISASSEMBLY AND ASSEMBLY

### INNER TRIPOD JOINT SEAL BOOT

#### REMOVAL

To remove sealing boots from driveshafts, the driveshaft assemblies must be removed from the vehicle. See Servicing Driveshaft for the required driveshaft removal and replacement procedure.

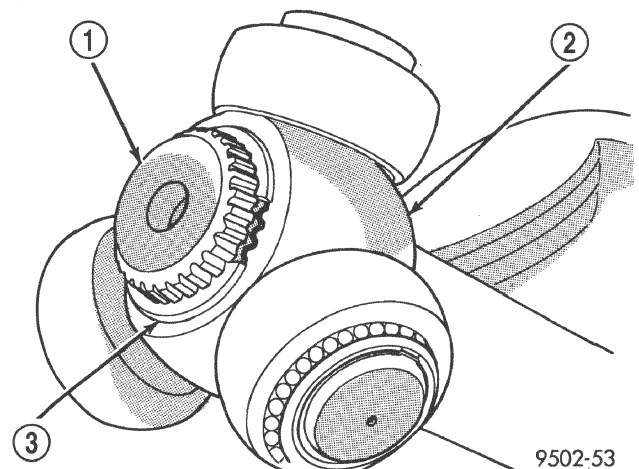
The inner tripod joints use no internal retention in the tripod housing to keep the spider assembly in the housing. Therefore, do not pull on the interconnecting shaft to disengage tripod housing from transmission stub shaft. Removal in this manner will cause damage to the inboard joint sealing boots.

(1) Remove the driveshaft requiring boot replacement from the vehicle. See Servicing Driveshaft for the required driveshaft removal procedure.

(2) Remove large boot clamp which retains inner tripod joint sealing boot to tripod joint housing and discard. Remove small clamp which retains inner tripod joint sealing boot to interconnecting shaft and discard. Remove the sealing boot from the tripod housing and slide it down the interconnecting shaft.

**CAUTION:** When removing the tripod joint housing from the spider assembly, hold the bearings in place on the spider trunions to prevent the bearings from falling away.

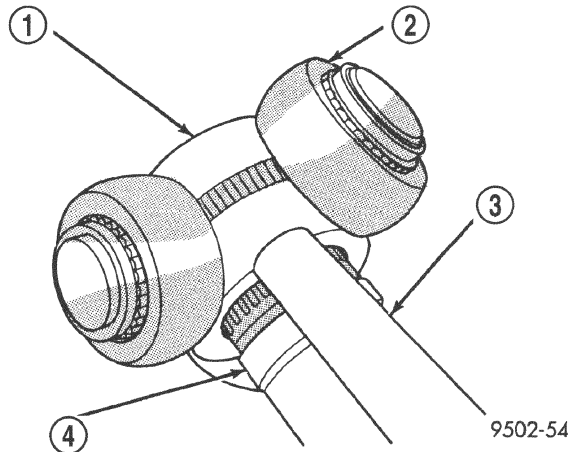
(4) Remove snap ring which retains spider assembly to interconnecting shaft (Fig. 27). Remove the spider assembly from interconnecting shaft. If spider assembly will not come off interconnecting shaft by hand, it can be removed by tapping spider assembly with a brass drift (Fig. 28). **Do not hit the outer tripod bearings in an attempt to remove spider assembly from interconnecting shaft.**



**Fig. 27 Spider Assembly Retaining Snap Ring**

- 1 - INTERCONNECTING SHAFT
- 2 - SPIDER ASSEMBLY
- 3 - RETAINING SNAP RING

(5) Slide sealing boot off interconnecting shaft.

**DISASSEMBLY AND ASSEMBLY (Continued)**

**Fig. 28 Spider Assembly Removal from Interconnecting Shaft**

- 1 - SPIDER ASSEMBLY
- 2 - DO NOT HIT SPIDER ASSEMBLY BEARINGS WHEN REMOVING SPIDER ASSEMBLY
- 3 - BRASS DRIFT
- 4 - INTERCONNECTING SHAFT

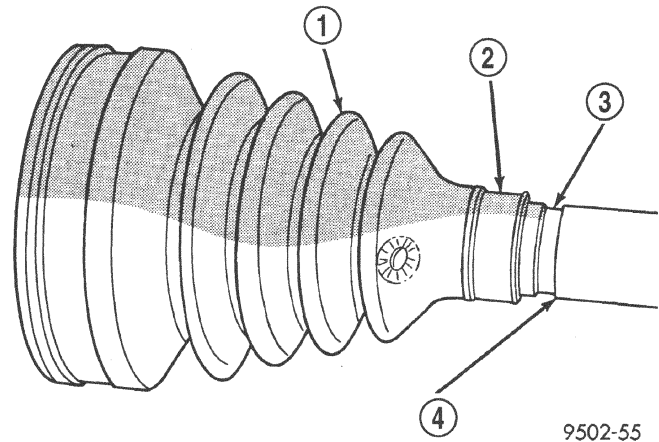
(6) Thoroughly clean and inspect spider assembly, tripod joint housing, and interconnecting shaft for any signs of excessive wear. **If any parts show signs of excessive wear, the driveshaft assembly will require replacement. Component parts of these driveshaft assemblies are not serviceable.**

**INSTALLATION**

**NOTE:** The inner tripod joint sealing boots are made from two different types of material. High temperature applications use silicone rubber where as standard temperature applications use hytrel plastic. The silicone sealing boots are soft and pliable. The Hytrel sealing boots are stiff and rigid. The replacement sealing boot **MUST BE** the same type of material as the sealing boot which was removed.

(1) Slide inner tripod joint seal boot retaining clamp, onto interconnecting shaft. Then, slide the replacement inner tripod joint sealing boot onto the interconnecting shaft. **Inner tripod joint seal boot MUST be positioned on interconnecting shaft, so the raised bead on the inside of the seal boot is in groove on interconnecting shaft (Fig. 29).**

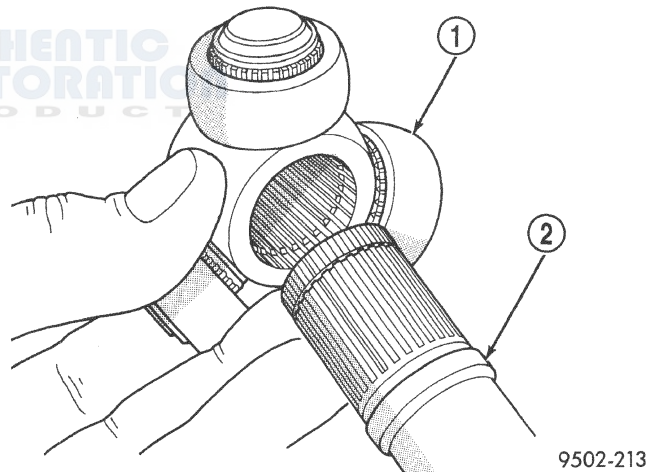
(2) Install spider assembly onto interconnecting shaft (Fig. 30). Spider assembly must be installed on interconnecting shaft far enough to fully install spider retaining snap ring. If spider assembly will not fully install on interconnecting shaft by hand, it can be installed by tapping the spider body with a brass drift (Fig. 31). **Do not hit the outer tripod bear-**



**Fig. 29 Sealing Boot Installation on Interconnecting Shaft**

- 1 - SEALING BOOT
- 2 - RAISED BEAD IN THIS AREA OF SEALING BOOT
- 3 - GROOVE
- 4 - INTERCONNECTING SHAFT

**ings in an attempt to install spider assembly on interconnecting shaft.**



**Fig. 30 Spider Assembly Installation on Interconnecting Shaft**

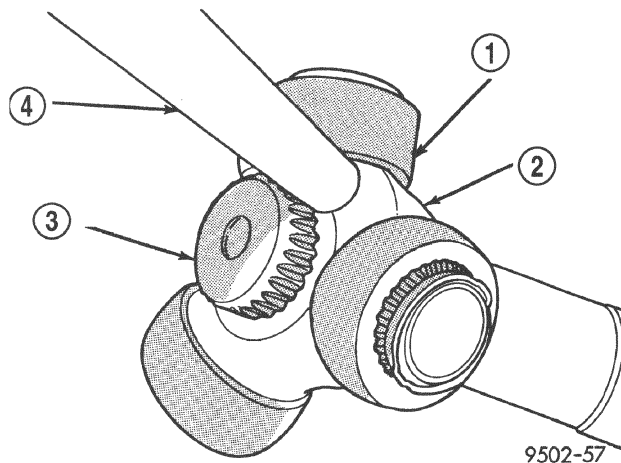
- 1 - SPIDER ASSEMBLY
- 2 - INTERCONNECTING SHAFT

(3) Install the spider assembly to interconnecting shaft retaining snap ring into groove on end of interconnecting shaft (Fig. 32). Be sure the snap ring is fully seated into groove on interconnecting shaft.

(4) Distribute 1/2 the amount of grease provided in the seal boot service package (**DO NOT USE ANY OTHER TYPE OF GREASE**) into tripod housing. Put the remaining amount into the sealing boot.

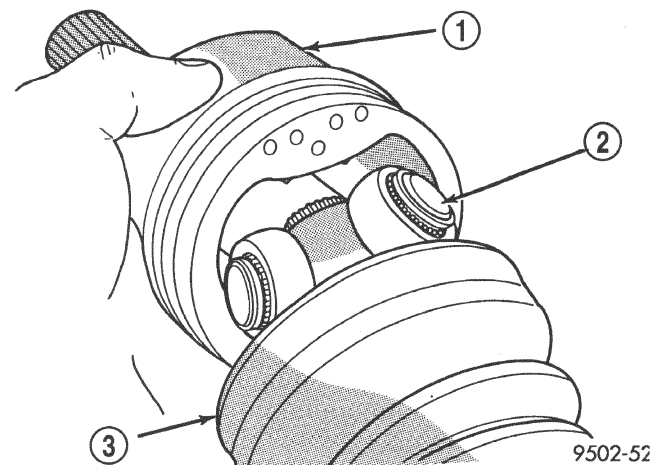
(5) Align tripod housing with spider assembly and then slide tripod housing over spider assembly and interconnecting shaft (Fig. 33).



**DISASSEMBLY AND ASSEMBLY (Continued)**

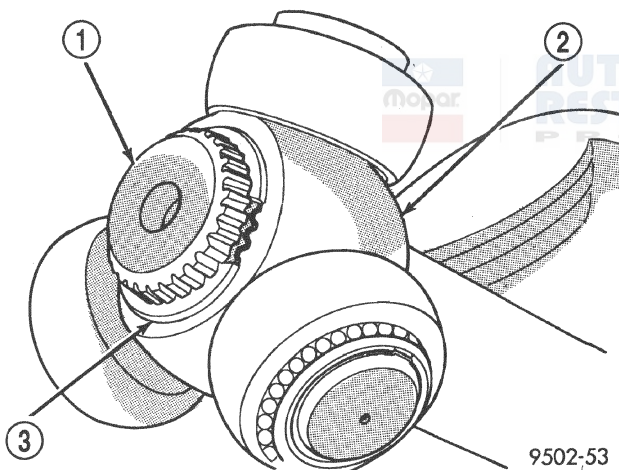
**Fig. 31 Installing Spider Assembly on Interconnecting Shaft**

- 1 - DO NOT HIT BEARINGS WHEN INSTALLING THE SPIDER ASSEMBLY
- 2 - SPIDER ASSEMBLY
- 3 - INTERCONNECTING SHAFT
- 4 - BRASS DRIFT



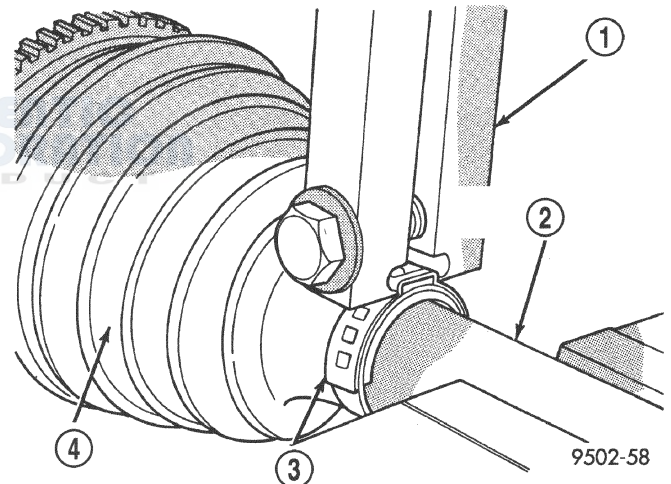
**Fig. 33 Installing Tripod Housing on Spider Assembly**

- 1 - TRIPOD JOINT HOUSING
- 2 - SPIDER ASSEMBLY
- 3 - SEALING BOOT



**Fig. 32 Spider Assembly Retaining Snap Ring Installed**

- 1 - INTERCONNECTING SHAFT
- 2 - SPIDER ASSEMBLY
- 3 - RETAINING SNAP RING



**Fig. 34 Crimping Tool Installed on Sealing Boot Clamp**

- 1 - SPECIAL TOOL C-4975A
- 2 - INTERCONNECTING SHAFT
- 3 - CLAMP
- 4 - SEALING BOOT

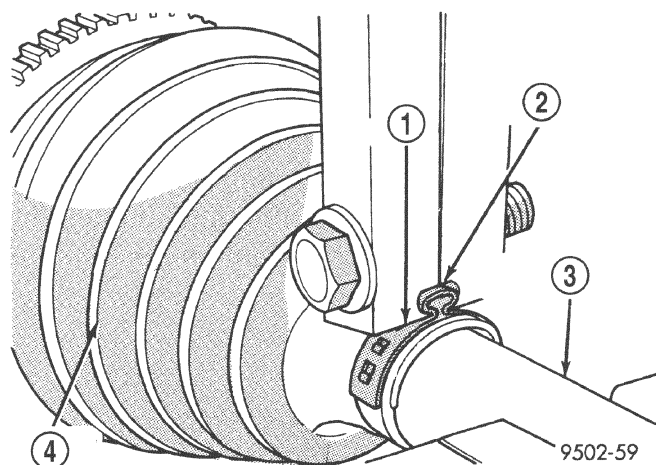
(6) Install inner tripod joint seal boot to interconnecting shaft clamp evenly on sealing boot.

(7) Clamp sealing boot onto interconnecting shaft using crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C-4975-A over bridge of clamp (Fig. 34). Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face (Fig. 35).

**CAUTION:** Seal must not be dimpled, stretched or out of shape in any way. If seal is NOT shaped correctly, equalize pressure in seal and shape it by hand.

(8) Position sealing boot into the tripod housing retaining groove. Install seal boot retaining clamp evenly on sealing boot.



**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 35 Sealing Boot Retaining Clamp Installed**

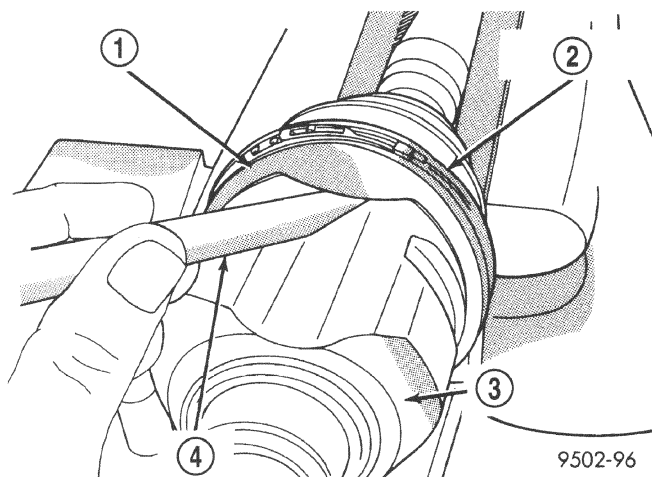
- 1 - CLAMP
- 2 - JAWS OF SPECIAL TOOL C-4975A MUST BE CLOSED COMPLETELY TOGETHER HERE
- 3 - INTERCONNECTING SHAFT
- 4 - SEALING BOOT

**CAUTION:** The following positioning procedure determines the correct air pressure inside the inner tripod joint assembly prior to clamping the sealing boot to inner tripod joint housing. If this procedure is not done prior to clamping sealing boot to tripod joint housing sealing boot durability can be adversely affected.

**CAUTION:** When venting the inner tripod joint assembly, use care so inner tripod sealing boot does not get punctured, or in any other way damaged. If sealing boot is punctured, or damaged in any way while being vented, the sealing boot can not be used.

(9) Insert a trim stick between the tripod joint and the sealing boot to vent inner tripod joint assembly (Fig. 36). **When inserting trim stick between tripod housing and sealing boot ensure trim stick is held flat and firmly against the tripod housing. If this is not done damage to the sealing boot can occur.** If inner tripod joint has a Hytrel (hard plastic) sealing boot, be sure trim stick is inserted between soft rubber insert and tripod housing not the hard plastic sealing boot and soft rubber insert.

(10) With trim stick inserted between sealing boot and tripod joint housing, position the interconnecting shaft so it is at the center of its travel in the tripod joint housing. Remove the trim stick from between the sealing boot and the tripod joint housing. **This procedure will equalize the air pressure in the**

**Fig. 36 Trim Stick Inserted for Venting Tripod Joint**

- 1 - INNER TRIPOD JOINT SEALING BOOT
- 2 - SEALING BOOT CLAMP
- 3 - INNER TRIPOD JOINT HOUSING
- 4 - TRIM STICK

**tripod joint, preventing premature sealing boot failure.**

(11) Position trilobal boot to interface with the tripod housing. The lobes of the boot must be properly aligned with the recess's of the tripod housing.

(12) Clamp tripod joint sealing boot to tripod joint, using required procedure for type of boot clamp application.

**CRIMP TYPE BOOT CLAMP**

If seal boot uses crimp type boot clamp:

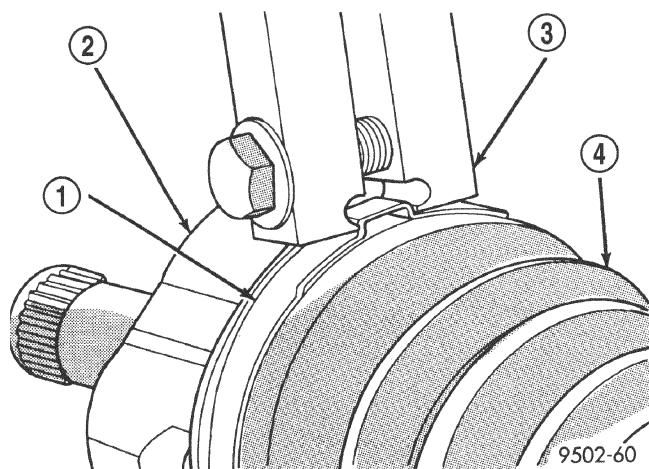
- Clamp sealing boot onto tripod housing using Crimper, Special Tool C-4975-A.
- Place crimping tool C-4975-A over bridge of clamp (Fig. 37).
- Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face (Fig. 38).

**LATCHING TYPE BOOT CLAMP**

If seal boot uses low profile latching type boot clamp:

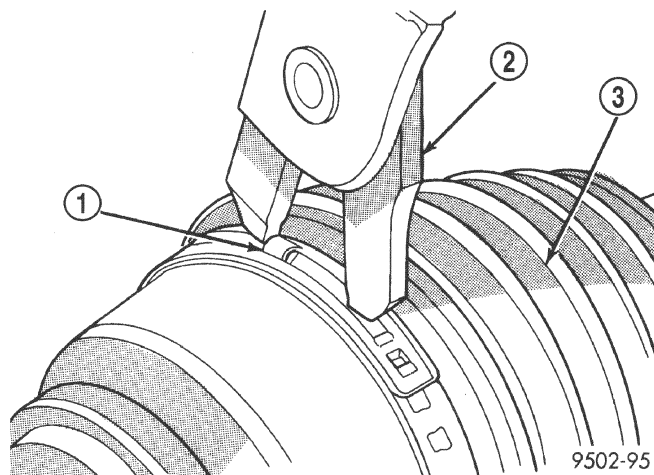
- Clamp sealing boot onto tripod housing using clamp locking tool, Snap-On YA3050 or an equivalent.
- Place prongs of clamp locking tool in the holes of the clamp (Fig. 39).
- Squeeze tool together until top band of clamp is latched behind the two tabs on lower band of clamp (Fig. 40).

(13) Install the driveshaft back on the vehicle. See Servicing Driveshaft, for the required driveshaft installation procedure.

**DISASSEMBLY AND ASSEMBLY (Continued)**

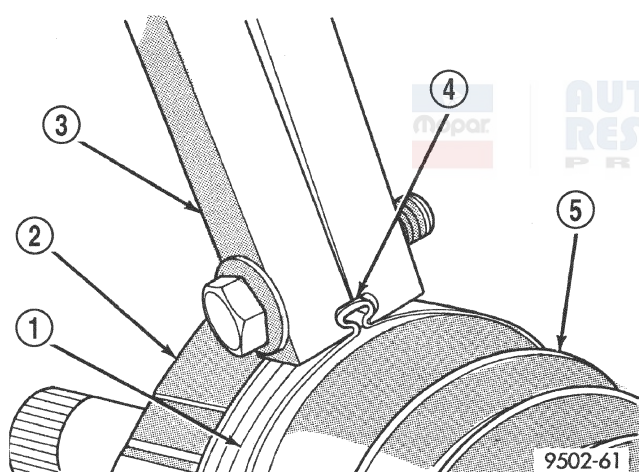
**Fig. 37 Crimping Tool Installed on Sealing Boot Clamp**

- 1 - CLAMP
- 2 - TRIPOD JOINT HOUSING
- 3 - SPECIAL TOOL C-4975A
- 4 - SEALING BOOT



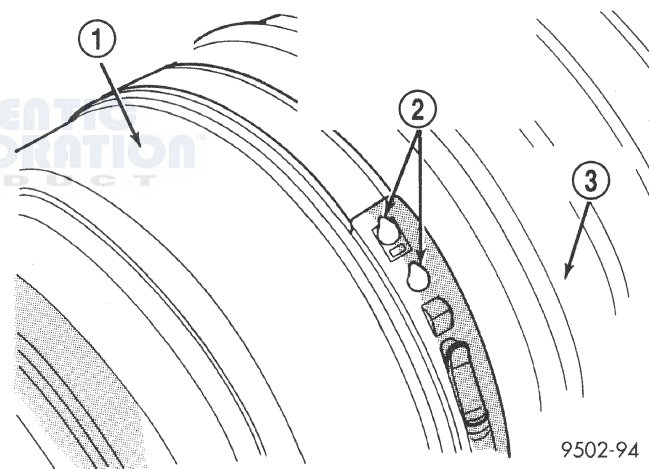
**Fig. 39 Clamping Tool Installed on Sealing Boot Clamp**

- 1 - CLAMP
- 2 - SPECIAL TOOL YA3050
- 3 - SEALING BOOT



**Fig. 38 Sealing Boot Retaining Clamp Installed**

- 1 - CLAMP
- 2 - TRIPOD HOUSING
- 3 - SPECIAL TOOL C-4975A
- 4 - JAWS OF SPECIAL TOOL C-4975A MUST BE CLOSED COMPLETELY TOGETHER HERE
- 5 - SEALING BOOT



**Fig. 40 Sealing Boot Clamp Correctly Installed**

- 1 - INNER TRIPOD JOINT HOUSING
- 2 - TOP BAND OF CLAMP MUST BE RETAINED BY TABS AS SHOWN HERE TO CORRECTLY LATCH BOOT CLAMP
- 3 - SEALING BOOT

**OUTER C/V JOINT SEAL BOOT****REMOVAL**

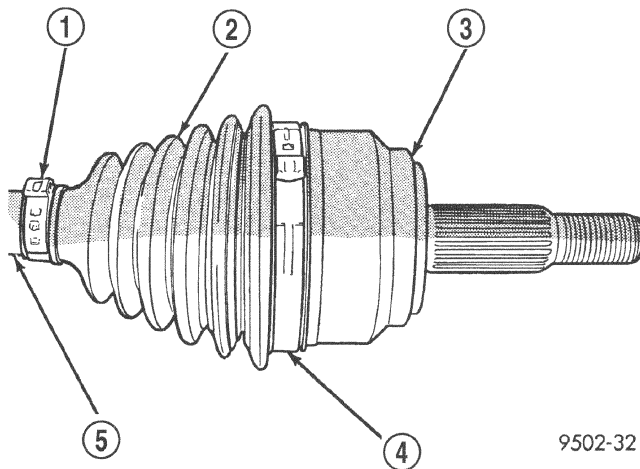
To remove outer C/V joint sealing boot from a driveshaft for replacement, the driveshaft assembly must be removed from the vehicle. See Driveshaft Removal and Installation in this section for the required driveshaft removal and replacement procedure.

(1) Remove driveshaft assembly requiring boot replacement from vehicle. See Driveshaft Removal and Installation in this section for the required driveshaft removal procedure.

(2) Remove large boot clamp retaining C/V joint sealing boot to C/V joint housing (Fig. 41) and discard. Remove small clamp that retains outer C/V joint sealing boot to interconnecting shaft and discard. Remove sealing boot from outer C/V joint housing and slide it down interconnecting shaft.

(3) Wipe away grease to expose outer C/V joint and interconnecting shaft.



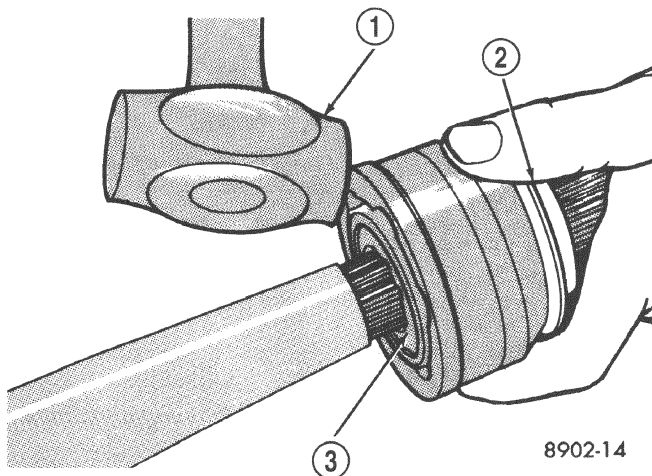
**DISASSEMBLY AND ASSEMBLY (Continued)**

9502-32

**Fig. 41 Outer C/V Joint Seal Boot Clamps**

- 1 - SMALL CLAMP
- 2 - SEALING BOOT
- 3 - OUTER C/V JOINT HOUSING
- 4 - LARGE CLAMP
- 5 - INTERCONNECTING SHAFT

(4) Remove outer C/V joint from interconnecting shaft using the following procedure: Support interconnecting shaft in a vise **equipped with protective caps on jaws of vise to prevent damage to interconnecting shaft**. Then, using a **soft-faced hammer**, sharply hit the end of the C/V joint housing to dislodge housing from internal circlip on interconnecting shaft (Fig. 42). Then slide outer C/V joint off end of interconnecting shaft, joint may have to be tapped off shaft using a **soft-faced hammer**.

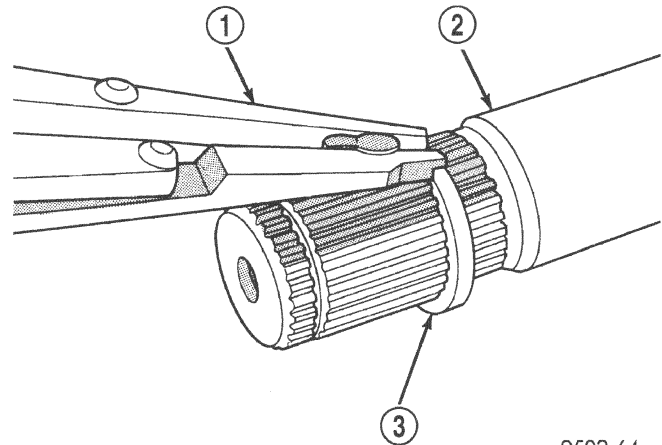


8902-14

**Fig. 42 Outer C/V Joint Removal from Interconnecting Shaft**

- 1 - SOFT HAMMER (TAP HOUSING)
- 2 - WEAR SLEEVE
- 3 - CIRCLIP (OUTER END OF SHAFT)

(5) Remove large circlip (Fig. 43) from the interconnecting shaft before attempting to remove outer C/V joint sealing boot.



9502-64

**Fig. 43 Circlip Removal from Interconnecting Shaft**

- 1 - SNAP RING PLIERS
- 2 - INTERCONNECTING SHAFT
- 3 - CIRCLIP

(6) Slide failed sealing boot off interconnecting shaft.

(7) Thoroughly clean and inspect outer C/V joint assembly and interconnecting joint for any signs of excessive wear. **If any parts show signs of excessive wear, the driveshaft assembly will require replacement. Component parts of these driveshaft assemblies are not serviceable.**

**INSTALLATION**

(1) Slide new sealing boot to interconnecting shaft retaining clamp onto interconnecting shaft. Slide the outer C/V joint assembly sealing boot onto the interconnecting shaft (Fig. 44). **Seal boot MUST be positioned on interconnecting shaft so the raised bead on the inside of the seal boot is in groove on interconnecting shaft.**

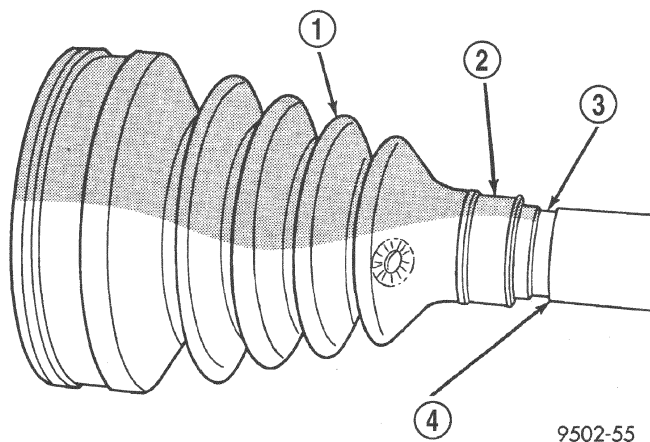
(2) Align splines on interconnecting shaft with splines on cross of outer C/V joint assembly and start outer C/V joint onto interconnecting shaft.

(3) Install outer C/V joint assembly onto interconnecting shaft by using a **soft-faced hammer** and tapping end of stub axle (with nut installed) until outer C/V joint is fully seated on interconnecting shaft (Fig. 45).

(4) Outer C/V joint assembly must be installed on interconnecting shaft until cross of outer C/V joint assembly is seated against circlip on interconnecting shaft (Fig. 46).

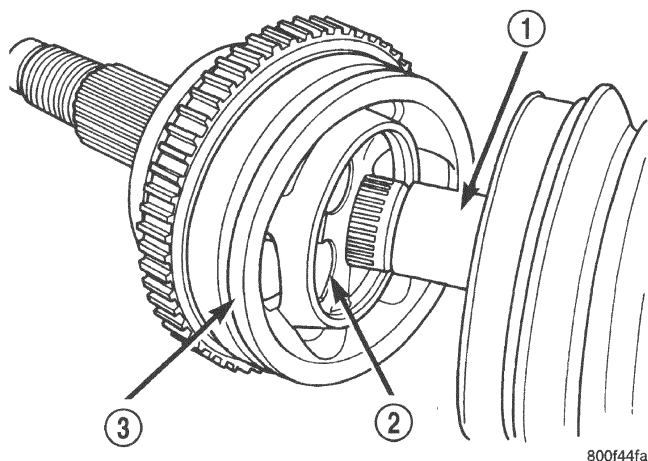
(5) Distribute 1/2 the amount of grease provided in seal boot service package (**DO NOT USE ANY OTHER TYPE OF GREASE**) into outer C/V joint



**DISASSEMBLY AND ASSEMBLY (Continued)**

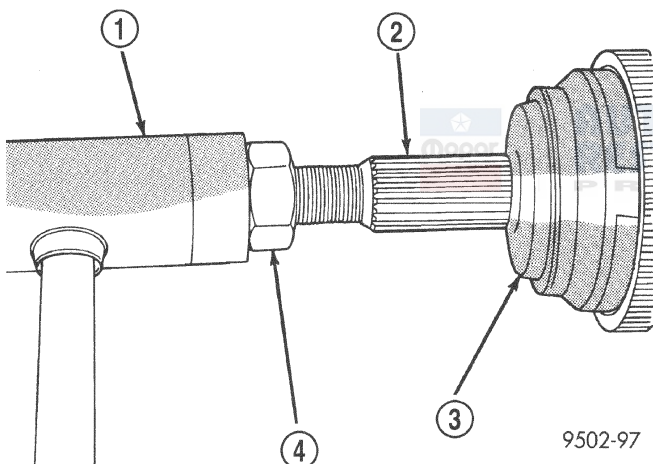
**Fig. 44 Sealing Boot Installation on Interconnecting Shaft**

- 1 - SEALING BOOT
- 2 - RAISED BEAD IN THIS AREA OF SEALING BOOT
- 3 - GROOVE
- 4 - INTERCONNECTING SHAFT



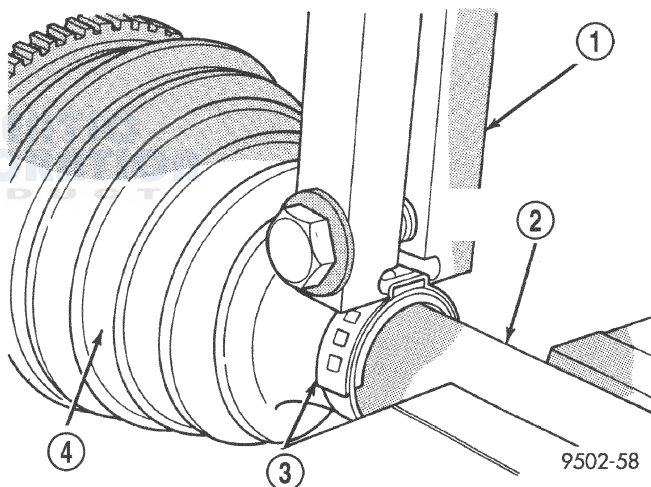
**Fig. 46 Outer C/V Joint Correctly Installed on Interconnecting Shaft**

- 1 - INTERCONNECTING SHAFT
- 2 - CROSS
- 3 - OUTER C/V JOINT ASSEMBLY



**Fig. 45 Outer C/V Joint Installation on Interconnecting Shaft**

- 1 - SOFT FACED HAMMER
- 2 - STUB AXLE
- 3 - OUTER C/V JOINT
- 4 - NUT



**Fig. 47 Crimping Tool Installed on Sealing Boot Clamp**

- 1 - SPECIAL TOOL C-4975A
- 2 - INTERCONNECTING SHAFT
- 3 - CLAMP
- 4 - SEALING BOOT

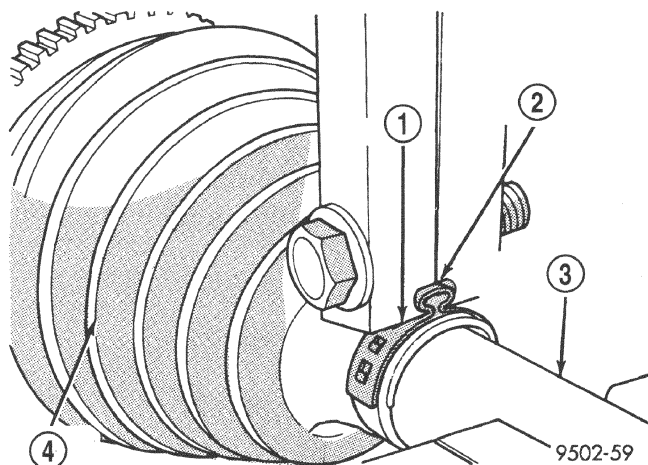
assembly housing. Put the remaining amount into the sealing boot.

(6) Install outer C/V joint sealing boot to interconnecting shaft clamp evenly on sealing boot.

(7) Clamp sealing boot onto interconnecting shaft using crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C-4975-A over bridge of clamp (Fig. 47). Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face (Fig. 48).

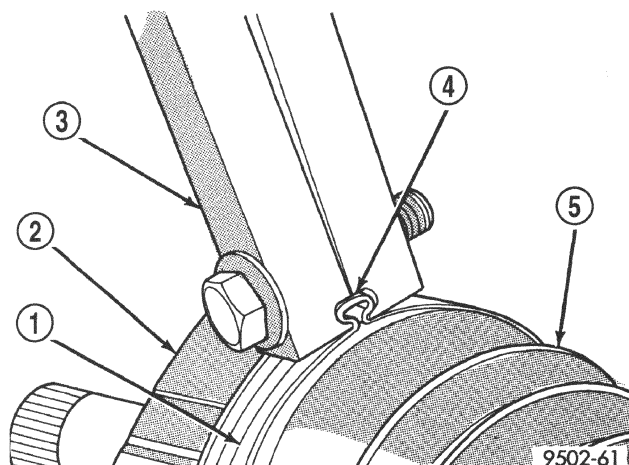
**CAUTION:** Seal must not be dimpled, stretched, or out-of-shape in any way. If seal is NOT shaped correctly, equalize pressure in seal and shape it by hand.

(8) Position outer C/V joint sealing boot into its retaining groove on outer C/V joint housing. Install sealing boot to outer C/V joint retaining clamp evenly on sealing boot.

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 48 Sealing Boot Retaining Clamp Installed**

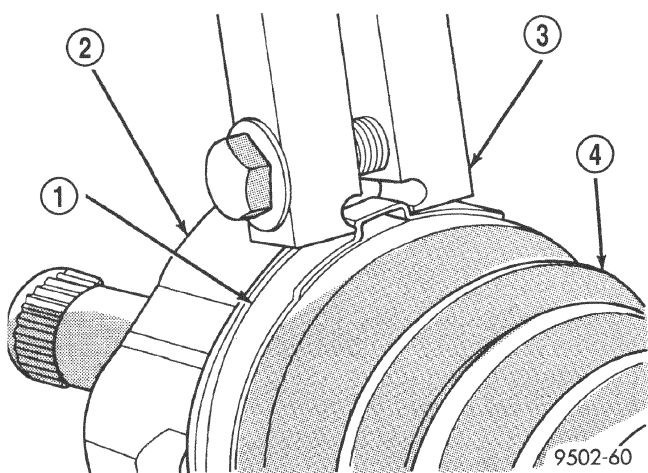
- 1 - CLAMP
- 2 - JAWS OF SPECIAL TOOL C-4975A MUST BE CLOSED COMPLETELY TOGETHER HERE
- 3 - INTERCONNECTING SHAFT
- 4 - SEALING BOOT

(9) Clamp sealing boot onto outer C/V joint housing using Crimper, Special Tool C-4975-A and the following procedure. Place crimping tool C-4975-A over bridge of clamp (Fig. 49). Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face (Fig. 50).

**Fig. 50 Sealing Boot Retaining Clamp Installed**

- 1 - CLAMP
- 2 - TRIPOD HOUSING
- 3 - SPECIAL TOOL C-4975A
- 4 - JAWS OF SPECIAL TOOL C-4975A MUST BE CLOSED COMPLETELY TOGETHER HERE
- 5 - SEALING BOOT

(10) Install the driveshaft requiring boot replacement back on the vehicle. See Driveshaft Removal and Installation in this section for the required driveshaft installation procedure.

**Fig. 49 Crimping Tool Installed on Sealing Boot Clamp**

- 1 - CLAMP
- 2 - TRIPOD JOINT HOUSING
- 3 - SPECIAL TOOL C-4975A
- 4 - SEALING BOOT

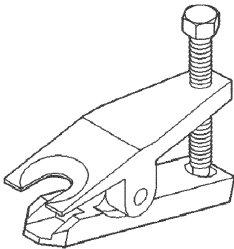
SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Caliper To Knuckle Bolts . . . . .	31 N·m (23 ft. lbs.)
Driveshaft Nut . . . . .	142 N·m (105 ft. lbs.)
Front Wheel Lug Nuts . . . . .	135 N·m (100 ft. lbs.)
Knuckle To Ball Stud Nut . . . . .	95 N·m (70 ft. lbs.)
Tie Rod End To Knuckle . . . . .	61 N·m (45 ft. lbs.)

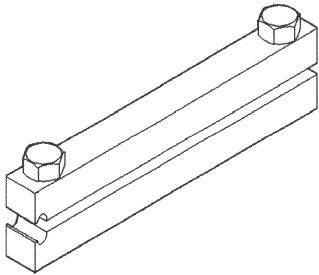
SPECIAL TOOLS

DRIVESHAFT



8011d8e1

Tie Rod Remover MB-991113



Boot Clamp Installer C-4975A



AUTHENTIC  
RESTORATION  
PRODUCT



# BRAKES

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## BASE BRAKE SYSTEM

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## DESCRIPTION AND OPERATION

### BASE BRAKE SYSTEM

#### DESCRIPTION

The base brake system consists of the following components:

- Brake pedal
- power brake booster
- brake tubes and hoses
- proportioning valves
- disc brakes
- drum brakes
- brake lamp switch
- brake fluid level switch
- parking brakes

Front disc brakes control the braking of the front wheels; rear braking is controlled by rear drum brakes as standard equipment. Rear disc brakes are optional.

The hydraulic brake system is diagonally split on both the non-antilock and antilock braking systems. This means the left front and right rear brakes are on one hydraulic circuit and the right front and left rear are on the other.

Vehicles equipped with the optional antilock brake system (ABS) use a system designated Mark 20i. This system shares most base brake hardware used on vehicles without ABS. A vehicle equipped with ABS, however, uses a different power brake booster, master cylinder, and brake tubes. Also included in the ABS system is an integrated control unit (ICU), four wheel speed sensors, and an electronic controller referred to as the controller antilock brake (CAB). These components are described in detail in the ANTILOCK BRAKE SYSTEM section in this group of the service manual.

#### OPERATION

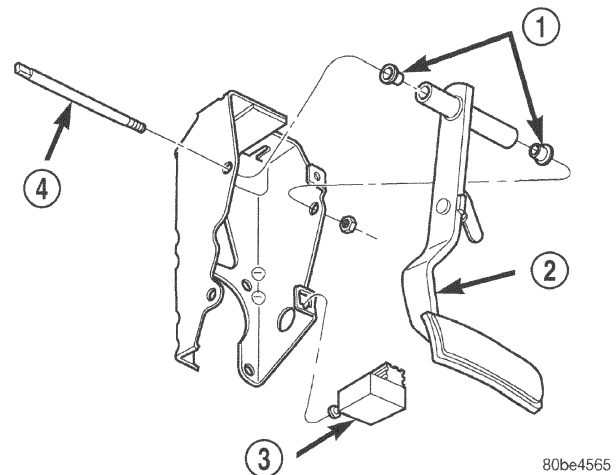
When a vehicle needs to be stopped, the driver applies the brake pedal. The brake pedal pushes the input rod of the power brake booster into the booster. The booster uses vacuum to ease pedal effort as force is transferred through the booster to the master cylinder. The booster's output rod pushes in the master cylinder's primary and secondary pistons applying hydraulic pressure through the chassis brake tubes and proportioning valves to the brakes at each tire and wheel assembly.

The parking brake is hand-operated. When applied, the parking brake lever pulls on cables that actuate brake shoes at each rear wheel.

### BRAKE PEDAL

#### DESCRIPTION

A suspended type brake pedal is used on this vehicle (Fig. 1). The pedal pivots on a shaft mounted in the pedal support bracket under the instrument panel. The pedal also connects to the power brake booster input rod.



**Fig. 1 Brake Pedal**

- 1 - BUSHINGS
- 2 - BRAKE PEDAL
- 3 - BRAKE LAMP SWITCH
- 4 - PIVOT SHAFT

#### OPERATION

When the brake pedal is depressed, it pushes in on the power brake booster input rod applying the brakes. At the same time, it allows the brake lamp switch's plunger to extend, thus applying the brake lamps.

### MASTER CYLINDER

#### DESCRIPTION

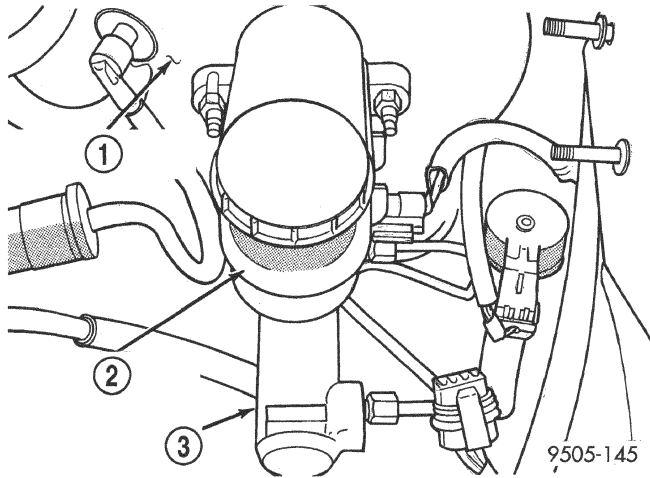
This vehicle uses 2 differently designed master cylinder assemblies depending on whether the vehicle is or is not equipped with antilock brakes.

Vehicles not equipped with ABS use a standard compensating port master cylinder design, while vehicles equipped with ABS use a center valve design master cylinder.

On vehicles equipped with ABS brakes, the master cylinder is a two outlet design. On vehicles not equipped with ABS brakes, the master cylinder is a 4 outlet design. All vehicles are equipped with a master cylinder having a bore diameter of 22.2 mm.

**DESCRIPTION AND OPERATION (Continued)**

The master cylinder assembly (Fig. 2) consists of the following components. The body of the master cylinder is an anodized aluminum casting. It has a machined bore to accept the master cylinder piston and threaded ports with seats for hydraulic brake line connections. The brake fluid reservoir of the master cylinder assembly is made of a see through plastic.

**Fig. 2 Master Cylinder**

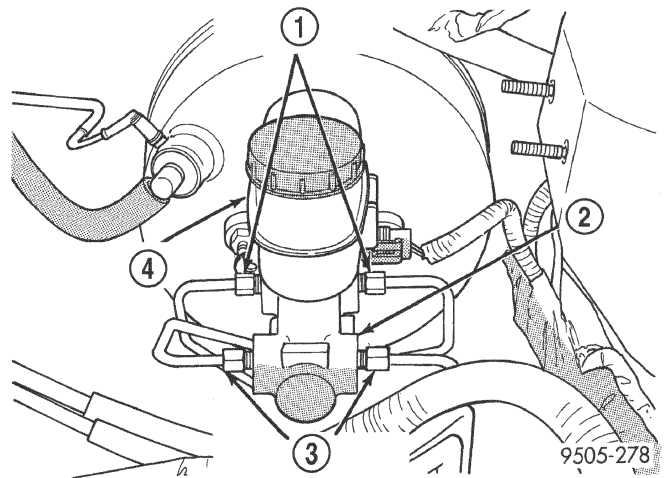
- 1 - POWER BRAKE VACUUM BOOSTER
- 2 - MASTER CYLINDER FLUID RESERVOIR
- 3 - MASTER CYLINDER BODY

**OPERATION**

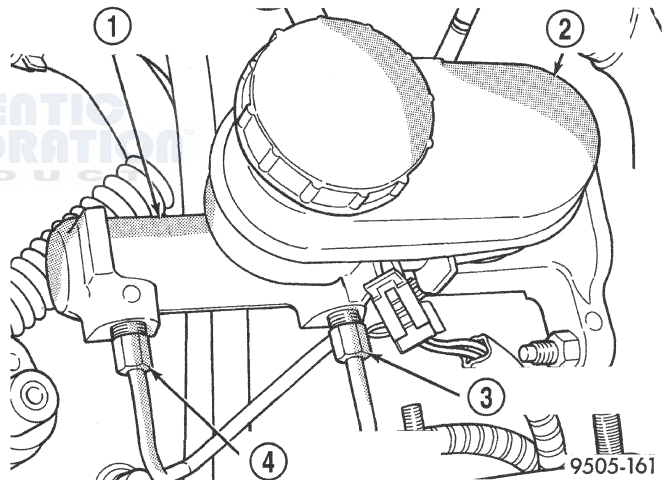
When the brake pedal is depressed, the master cylinder primary and secondary pistons apply brake pressure through the chassis brake tubes and proportioning valves to each brake assembly.

On Non-ABS master cylinders, the primary outlet ports (Fig. 3) supply hydraulic pressure to the right front and left rear brakes. The secondary outlet ports (Fig. 3) supply hydraulic pressure to the left front and right rear brakes.

On ABS master cylinders, the primary outlet port (Fig. 4) supplies hydraulic pressure to the right front and left rear brakes. The secondary outlet port (Fig. 4) supplies hydraulic pressure to the left front and right rear brakes.

**Fig. 3 Primary And Secondary Ports Without ABS**

- 1 - MASTER CYLINDER PRIMARY PORTS
- 2 - MASTER CYLINDER
- 3 - MASTER CYLINDER SECONDARY PORTS
- 4 - MASTER CYLINDER FLUID RESERVOIR

**Fig. 4 Primary And Secondary Ports With ABS**

- 1 - MASTER CYLINDER ASSEMBLY
- 2 - BRAKE FLUID RESERVOIR
- 3 - MASTER CYLINDER PRIMARY PORT
- 4 - MASTER CYLINDER SECONDARY PORT



**DESCRIPTION AND OPERATION (Continued)****POWER BRAKE BOOSTER****DESCRIPTION**

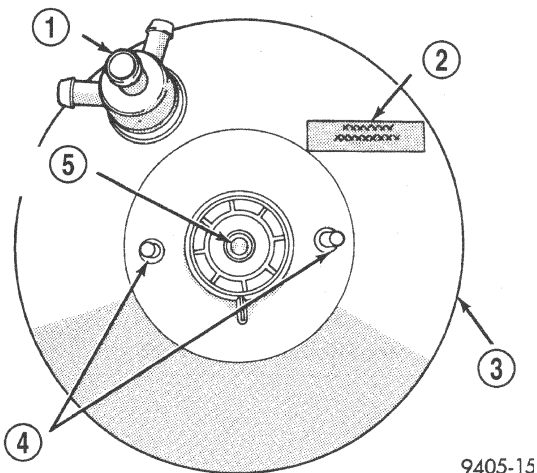
The power brake booster reduces the amount of force required by the driver to obtain the necessary hydraulic pressure to stop the vehicle.

The vacuum booster assembly mounts on the engine side of the dash panel. It is connected to the brake pedal by the input push rod (Fig. 6). A vacuum line connects the vacuum booster to the intake manifold. The master cylinder is bolted to the front of the vacuum booster assembly.

All vehicles use a 205 mm tandem diaphragm power brake vacuum booster. The vacuum booster though, may be unique for the type of brake system the vehicle is equipped with. For this reason, if the power brake vacuum booster requires replacement, be sure it is replaced with the correct part for the type of brake system that the vehicle is equipped with.

The booster can be identified if required, by the tag attached to the body of the booster (Fig. 5). This tag contains the following information: The production part number of the vacuum booster, the date it was built, and who manufactured it.

**NOTE: The booster assembly is not a repairable part and must be replaced as a complete unit if it is found to be faulty in any way. The vacuum booster check valve is not repairable but can be replaced as a component of the booster.**



9405-15

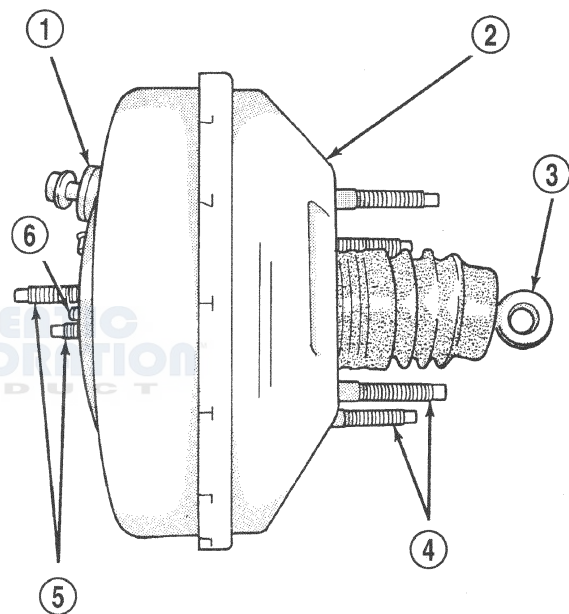
**Fig. 5 Power Brake Booster Identification**

- 1 - VACUUM CHECK VALVE
- 2 - PART IDENTIFICATION TAG
- 3 - POWER BRAKE BOOSTER ASSEMBLY
- 4 - MASTER CYLINDER MOUNTING STUDS
- 5 - MASTER CYLINDER PUSH ROD

**OPERATION**

The power brake booster is vacuum operated. The vacuum is supplied from the intake manifold on the engine through the power brake booster check valve (Fig. 5).

As the brake pedal is depressed, the vacuum booster's input rod moves forward (Fig. 6). This opens and closes valves in the vacuum booster, allowing atmospheric pressure to enter on one side of a diaphragm. Engine vacuum is always present on the other side. This difference in pressure forces the output rod of the vacuum booster (Fig. 6) out against the primary piston of the master cylinder. As the pistons in the master cylinder move forward this creates the hydraulic pressure in the brake system.



9405-16

**Fig. 6 Power Brake Booster**

- 1 - VACUUM CHECK VALVE
- 2 - POWER BRAKE BOOSTER ASSEMBLY
- 3 - INPUT ROD
- 4 - POWER BOOSTER ASSEMBLY TO DASH PANEL MOUNTING STUDS (4)
- 5 - MASTER CYLINDER MOUNTING STUDS (2)
- 6 - OUTPUT ROD

Different systems and engine combinations require different vacuum hose routings.

## DESCRIPTION AND OPERATION (Continued)

### BRAKE TUBES AND HOSES

#### DESCRIPTION

The chassis brake tubes are steel with a corrosion resistant coating applied to the external surfaces. The flex hoses are made of reinforced rubber.

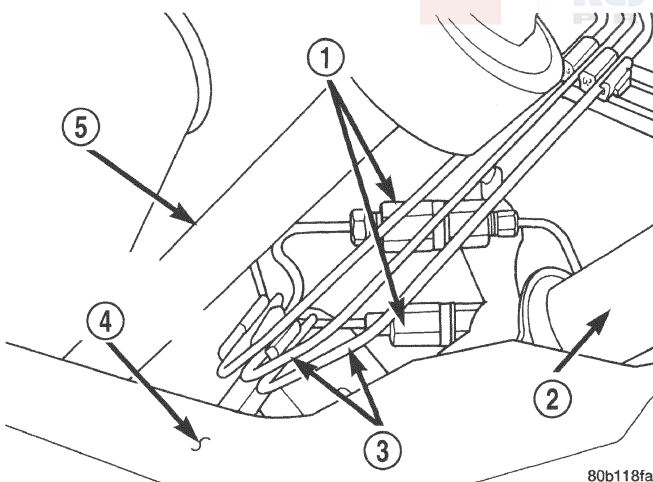
#### OPERATION

The purpose of the chassis brake tubes and flex hoses is to transfer the pressurized brake fluid developed by the master cylinder to the wheel brakes of the vehicle. The flex hoses are made of rubber to allow for the movement of the vehicle's suspension.

### PROPORTIONING VALVE

#### DESCRIPTION

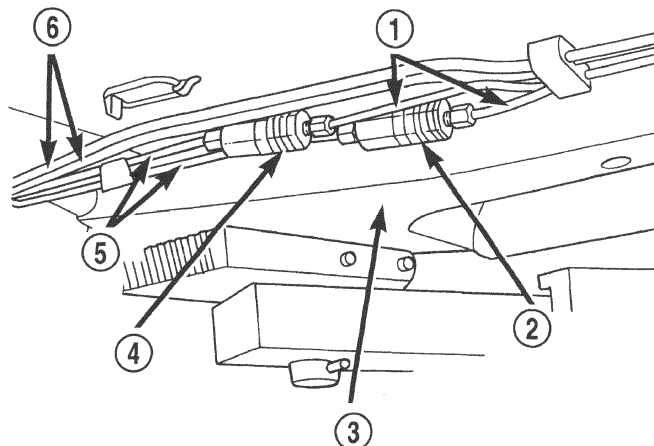
This vehicle uses proportioning valves that are in-line with the rear brake tubes. The chassis brake tubes connect directly from the master cylinder or HCU (ABS models) to the rear brake flex hose. The non ABS brake system uses two proportioning valves in-line with each of the rear wheel chassis brake tubes. Vehicles not equipped with ABS have the proportioning valves located on the front suspension crossmember in the same area as the hydraulic unit mounts on ABS equipped vehicles (Fig. 7).



**Fig. 7 Proportioning Valves For Non ABS Equipped Vehicles**

- 1 - PROPORTIONING VALVES
- 2 - STEERING GEAR
- 3 - CHASSIS BRAKE TUBES
- 4 - FRONT SUSPENSION CROSSMEMBER
- 5 - RIGHT DRIVESHAFT

On vehicles equipped with antilock brakes, the proportioning valves are located under the vehicle on the passenger side just rearward of the passenger seat. (Fig. 8). The proportioning valves mount directly in the chassis brake tube going to each of the vehicles rear brakes (Fig. 8).

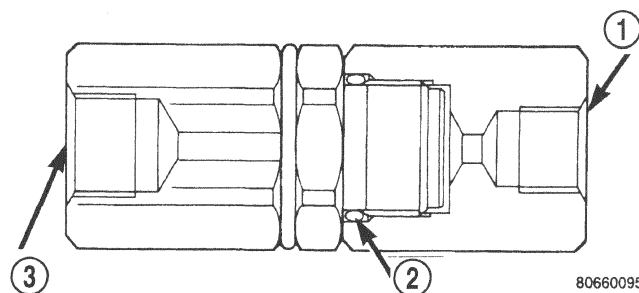


**Fig. 8 Proportioning Valve Location For Antilock Brake Equipped Vehicles**

- 1 - CHASSIS BRAKE TUBES
- 2 - RIGHT REAR BRAKE PROPORTIONING VALVE
- 3 - RIGHT FRAME RAIL
- 4 - LEFT REAR BRAKE PROPORTIONING VALVE
- 5 - CHASSIS BRAKE TUBES
- 6 - FUEL TUBES

For additional information and procedures on proportioning valves on vehicles with ABS, refer to the ANTILOCK BRAKE SYSTEM section.

There are two proportioning valve assemblies used in each vehicle. During any service procedures identify valve assemblies by supplier part number or the bar code label and stamp identification band (Fig. 9).



**Fig. 9 Proportioning Valve Identification**

- 1 - FROM MASTER CYLINDER
- 2 - O. RING SEAL
- 3 - TO REAR BRAKES

#### OPERATION

Proportioning valves balance front to rear braking by controlling at a given ratio, the increase in rear brake system hydraulic pressure above a preset level (split point). Under light pedal application, the proportioning valve allows full hydraulic pressure to be applied to the rear brakes.

This vehicle's brake system uses different calibrations for the proportioning valves depending on application.

**DESCRIPTION AND OPERATION (Continued)**

For specifications on valves for particular brake applications, refer to Diagnosis And Testing in this group.

**DISC BRAKES (FRONT)****DESCRIPTION**

The front disc brakes (Fig. 10) and (Fig. 11) consists of the following components:

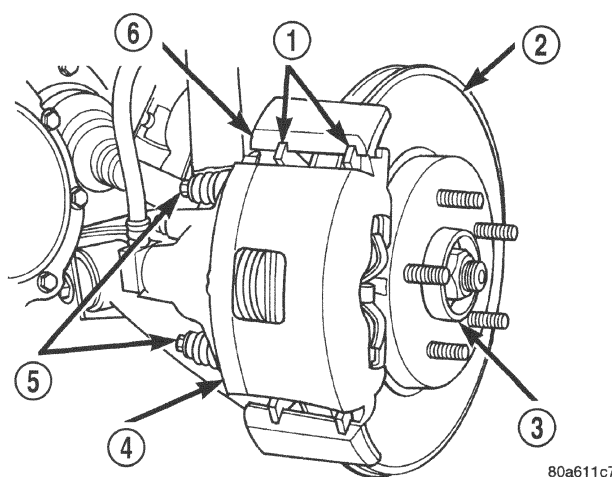
- Braking disc (brake rotor)
- Caliper assembly - single piston, floating type
- Brake pads and linings

The front disc brakes used on this vehicle are double pin floating calipers.

The front disc brake double pin calipers are mounted directly to the steering knuckles and use no adapter. The caliper is mounted to the steering knuckle using bushings, sleeves and 2 guide pin bolts which thread directly into bosses on the steering knuckle (Fig. 10), (Fig. 11) and (Fig. 12).

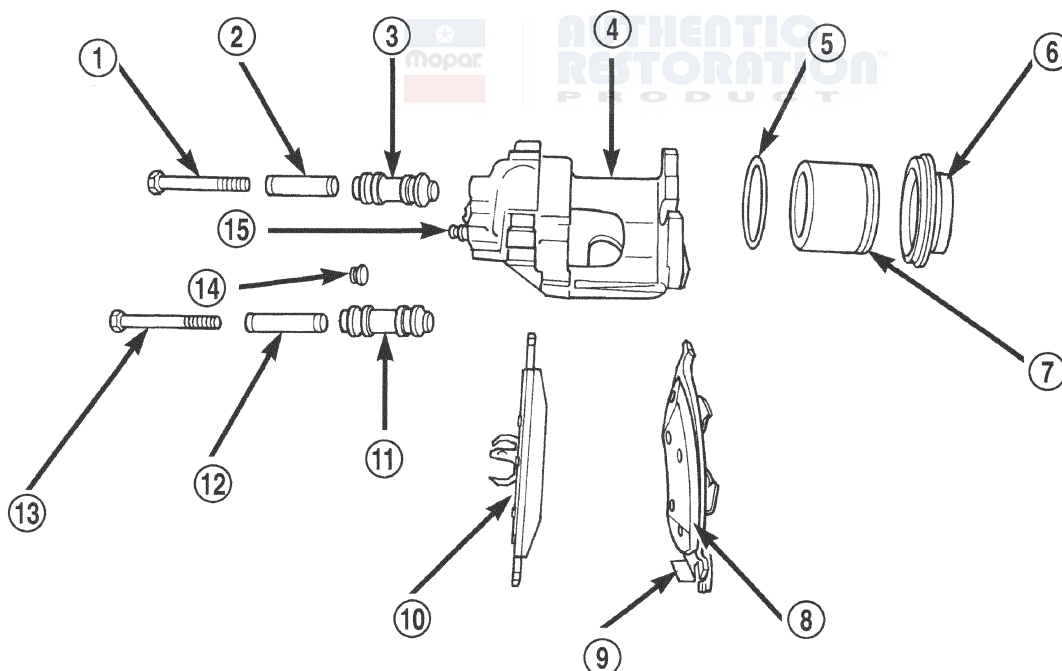
The caliper is a one piece casting with the inboard side containing a single piston cylinder bore.

The front disc brake caliper piston (Fig. 11), is manufactured from a phenolic compound. The outside diameter of the caliper piston is 54 mm.



**Fig. 10 Front Disc Brake Components**

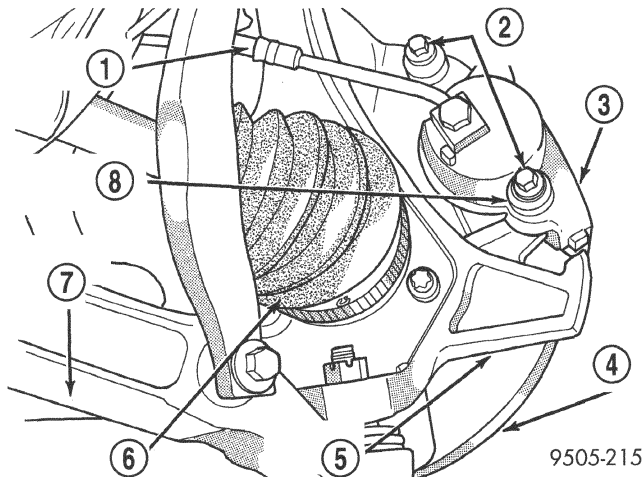
- 1 - BRAKE PADS AND LININGS
- 2 - BRAKE ROTOR
- 3 - DRIVING HUB
- 4 - CALIPER ASSEMBLY
- 5 - GUIDE PIN BOLTS
- 6 - STEERING KNUCKLE



**Fig. 11 Front Disc Brake Caliper (Exploded View)**

- 1 - CALIPER GUIDE PIN BOLT
- 2 - SLEEVE
- 3 - BUSHING
- 4 - CALIPER
- 5 - PISTON SEAL
- 6 - DUST SEAL
- 7 - PISTON
- 8 - OUTBOARD BRAKE SHOE
- 9 - WEAR INDICATOR
- 10 - INBOARD BRAKE SHOE
- 11 - BUSHING
- 12 - SLEEVE
- 13 - CALIPER GUIDE PIN BOLT
- 14 - CAP
- 15 - BLEEDER SCREW



**DESCRIPTION AND OPERATION (Continued)****Fig. 12 Front Disc Brake Caliper Mounting**

- 1 - BRAKE FLEX HOSE
- 2 - GUIDE PIN BOLTS
- 3 - CALIPER ASSEMBLY
- 4 - ROTOR
- 5 - STEERING KNUCKLE
- 6 - DRIVESHAFT
- 7 - LOWER CONTROL ARM
- 8 - BUSHINGS AND SLEEVES

**OPERATION**

Two machined abutments on the steering knuckle position the caliper. The guide pin bolts, sleeves and bushings control the side to side movement of the caliper. The piston seal is designed to pull the piston back into the bore of the caliper when the brake pedal is released. This maintains the proper brake shoe to rotor clearance (Fig. 13).

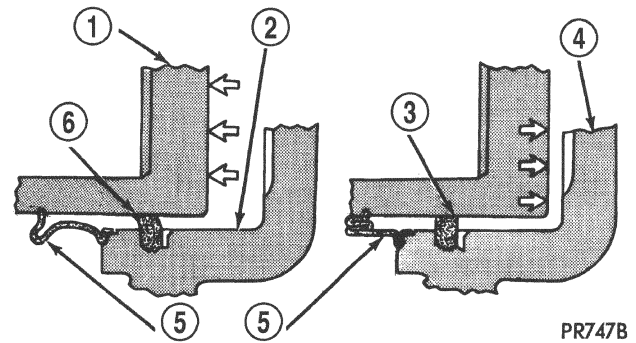
All the front brake forces generated during braking of the vehicle are taken up directly by the steering knuckles of the vehicle.

A square cut rubber piston seal is located in a machined groove in the caliper cylinder bore. This provides a hydraulic seal between the piston and the cylinder wall (Fig. 13).

A rubber dust boot is installed in the cylinder bore opening and in a groove in the piston (Fig. 13). This prevents contamination in the bore area.

As front disc brake linings wear, master cylinder reservoir brake fluid level will drop. Fluid level should be checked after replacing linings.

Front disc brakes are equipped with an audible wear sensor (Fig. 11) on the outboard brake pad. This sensor emits a sound when the brake lining may need inspection or replacement.

**Fig. 13 Piston Seal Function for Automatic Adjustment**

- 1 - PISTON
- 2 - CYLINDER BORE
- 3 - PISTON SEAL BRAKE PRESSURE OFF
- 4 - CALIPER HOUSING
- 5 - DUST BOOT
- 6 - PISTON SEAL BRAKE PRESSURE ON

**DISC BRAKES (REAR)****DESCRIPTION**

The rear disc brakes are similar to the front disc brakes, however, there are several distinctive features that require different service procedures. The single piston, floating caliper rear disc brake assembly includes a hub and bearing assembly, adapter, brake rotor, caliper, brake pads/linings.

The parking brake system on all vehicles equipped with rear disc brakes consists of a small duo-servo drum brake mounted to the caliper adapter. The drum brake shoes expand out against a braking surface (hat section) on the inside area of the rotor.

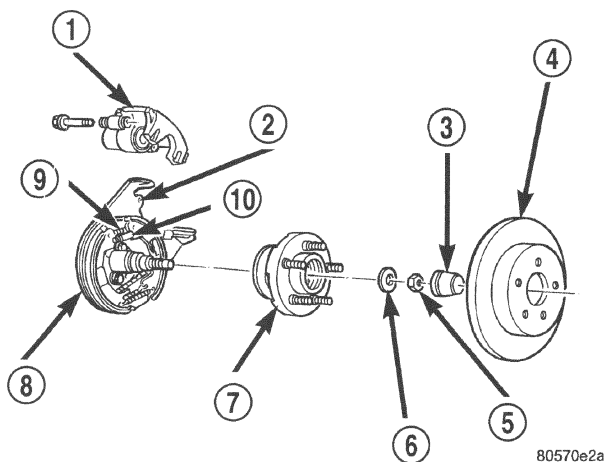
Vehicles are equipped with a caliper assembly that has a 33.4 mm (1.31 in.) piston and uses a solid non-vented rotor.

The caliper assembly on all applications float on rubber bushings using internal metal sleeves which are attached to the adapter using threaded guide pin bolts.

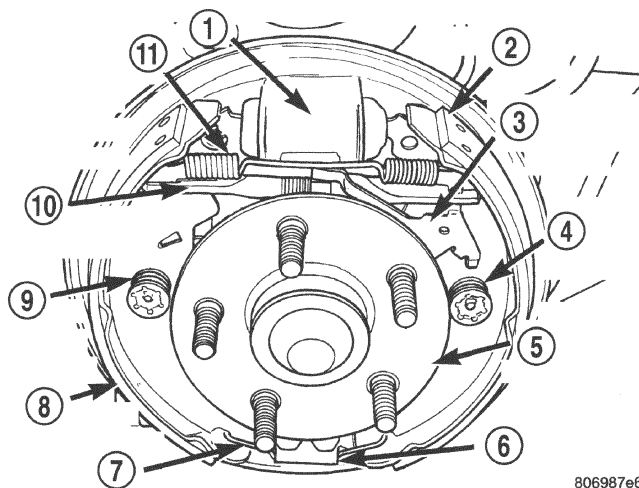
The adapter and rotor shield are mounted to the rear suspension knuckles of vehicle. The adapter is used to mount the brake shoes and actuating cables for the parking brake system. The adapter also mounts the rear caliper assembly to the vehicle. The adapter has two machined abutments which are used to position and align the caliper and brake pads for movement inboard and outboard (Fig. 14).

**OPERATION**

Rear disc brakes operate similarly to front disc brakes.

**DESCRIPTION AND OPERATION (Continued)****Fig. 14 Rear Disc Brake Exploded View**

- 1 - CALIPER ASSEMBLY
- 2 - ADAPTER
- 3 - DUST CAP
- 4 - DISC
- 5 - NUT
- 6 - WASHER
- 7 - HUB/BEARING ASSEMBLY
- 8 - PARKING BRAKE SHOES
- 9 - RETURN SPRING
- 10 - ADJUSTER

**Fig. 15 Rear Wheel Drum Brake Assembly**

- 1 - WHEEL CYLINDER
- 2 - LEADING BRAKE SHOE
- 3 - AUTOMATIC ADJUSTER LEVER
- 4 - HOLD DOWN SPRING
- 5 - HUB/BEARING ASSEMBLY
- 6 - BRAKE SHOE ANCHOR
- 7 - BRAKE SHOE LOWER RETURN SPRING
- 8 - TRAILING BRAKE SHOE
- 9 - HOLD DOWN SPRING
- 10 - AUTOMATIC ADJUSTER
- 11 - BRAKE SHOE UPPER RETURN SPRING

**DRUM BRAKES (REAR)****DESCRIPTION**

This vehicle's rear wheel drum brakes are a two shoe leading/trailing internal expanding type, with an automatic self-adjuster mechanism (Fig. 15). The automatic self-adjuster mechanism used on this vehicle is a screw type adjuster. The automatic self-adjuster mechanism is located directly below the rear wheel cylinder (Fig. 15).

**OPERATION**

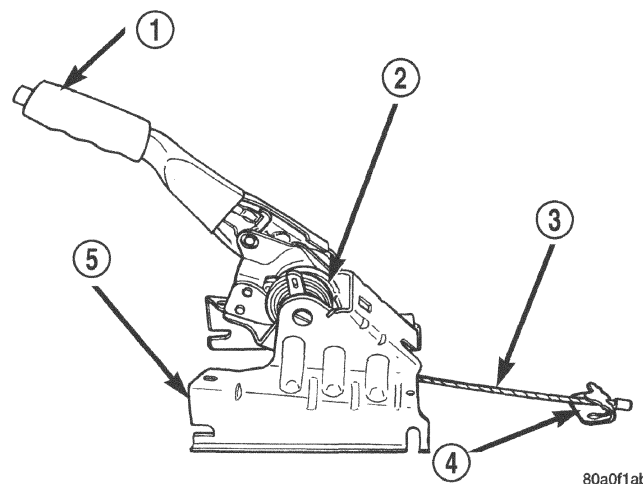
This vehicle's rear wheel drum brake shoes expand outward against the drum when applied. The automatic self-adjuster mechanism is actuated each time the vehicles service brakes are applied.

**PARKING BRAKES****DESCRIPTION**

All vehicles are equipped with a center mounted, hand operated parking brake lever (Fig. 16). This lever is an auto-adjust type.

On vehicles with rear drum brakes, the rear wheel service brakes act as the vehicle's parking brakes.

The parking brakes on vehicles equipped with rear disc brakes consist of a small duo-servo brake assembly mounted to the disc brake caliper adapter (Fig. 17). The hat (center) section (Fig. 18) of the rear

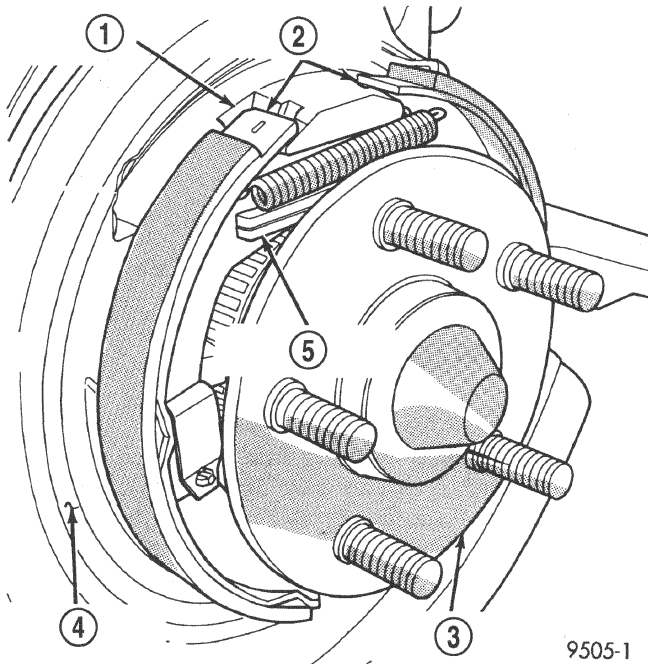
**Fig. 16 Park Brake Lever Assembly**

- 1 - HAND LEVER
- 2 - AUTOMATIC ADJUSTER MECHANISM
- 3 - OUTPUT CABLE
- 4 - PARK BRAKE LEVER ASSEMBLY

rotor serves as the braking surface (drum) for the parking brakes.

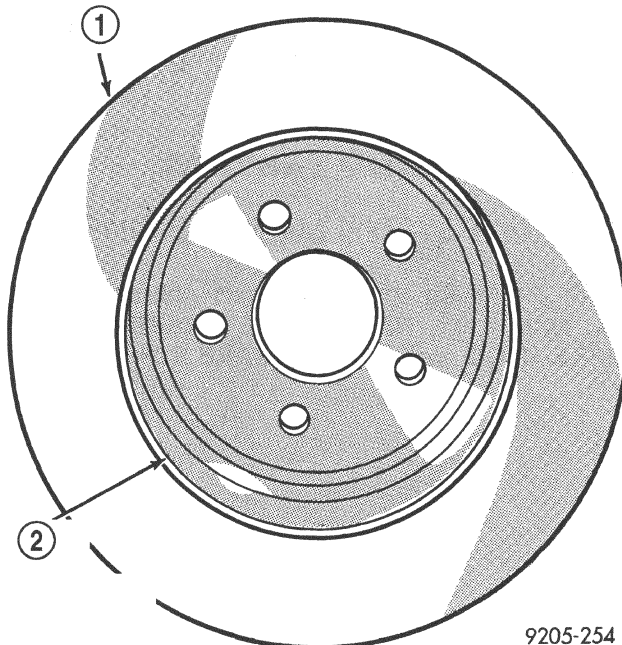
The parking brake lever has a short output cable that connects the lever to the rear cables. The parking brake lever output cable is not replaceable as a separate component of the parking brake lever.



**DESCRIPTION AND OPERATION (Continued)**

**Fig. 17 Parking Brake Assembly With Rear Disc Brakes**

- 1 - DISC BRAKE ADAPTER
- 2 - PARKING BRAKE BRAKE SHOES
- 3 - HUB/BEARING ASSEMBLY
- 4 - BRAKING DISC STONE SHIELD
- 5 - PARKING BRAKE ACTUATING STRUT



**Fig. 18 Drum In Hat Rotor**

- 1 - REAR BRAKING DISK ROTOR
- 2 - HAT SECTION OF REAR BRAKING DISC (PARKING BRAKE BRAKING SURFACE)

**OPERATION**

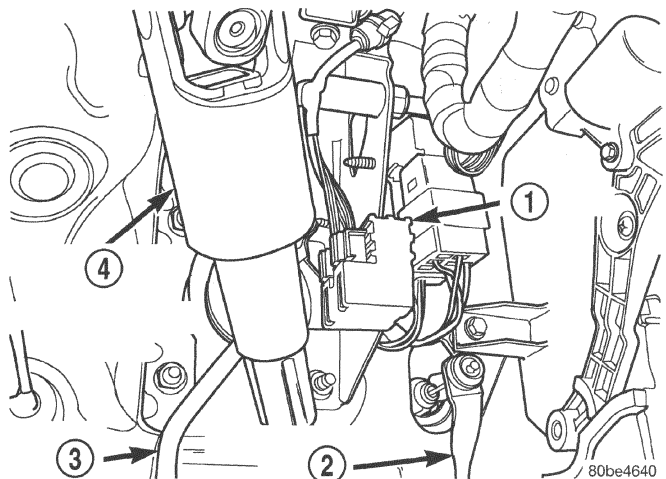
The parking brake lever is an auto-adjust type which continuously applies minimal tension to the parking brake cables to keep them in adjustment at all times. Due to this feature, the park brake cable system does not require adjustment. Proper parking brake system adjustment is obtained by proper rear drum brake shoe adjustment.

The rear drum brake shoes, when acting as parking brakes, are mechanically operated using an internal actuating lever and strut which is connected to a flexible steel cable. There is an individual park brake cable for each rear wheel, which are joined using a park cable equalizer before terminating at the floor mounted, hand operated park brake lever.

The parking brakes on vehicles equipped with rear disc brakes consist of a small duo-servo brake assembly mounted to the disc brake caliper adapter which expands its shoes outward against the hat (center) section of the disc brake rotor when applied (Fig. 17). This parking brake application uses the same operating cable configuration as the drum brake equipped vehicles, but different cables.

**BRAKE LAMP SWITCH****DESCRIPTION**

The brake lamp switch is located under the instrument panel at the brake pedal arm (Fig. 19). It controls operation of the vehicle's brake lamps. Also, if the vehicle is equipped with speed control, the brake lamp switch will deactivate speed control when the brake pedal is depressed.



**Fig. 19 Brake Lamp Switch**

- 1 - SWITCH
- 2 - ACCELERATOR PEDAL
- 3 - BRAKE PEDAL
- 4 - STEERING COLUMN INTERMEDIATE SHAFT

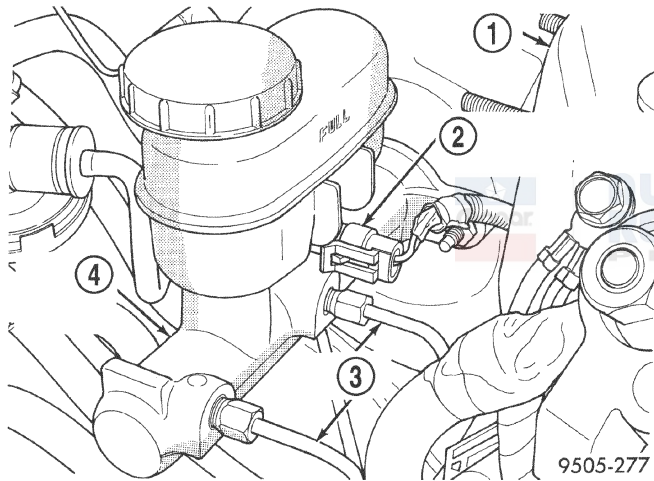


**DESCRIPTION AND OPERATION (Continued)****OPERATION**

When the brake pedal is depressed, the plunger on the outside of the switch extends outward. This action closes the electrical contacts within the switch, completing the circuit to the brake lamps at the rear of the vehicle, thus illuminating the brake lamps and the center-high-mounted stop lamp (CHMSL).

**BRAKE FLUID LEVEL SWITCH****DESCRIPTION**

The brake fluid level switch is located in the brake fluid reservoir of the master cylinder assembly (Fig. 20). The purpose of the sensor is to provide the driver with an early warning that brake fluid level in master cylinder reservoir has dropped to below normal. This may indicate an abnormal loss of brake fluid in the master cylinder fluid reservoir resulting from a leak in the hydraulic system.



**Fig. 20 Master Cylinder Fluid Level Switch**

- 1 - LEFT SHOCK TOWER
- 2 - MASTER CYLINDER FLUID LEVEL SENSOR
- 3 - BRAKE TUBES
- 4 - MASTER CYLINDER ASSEMBLY

**OPERATION**

As the fluid drops below the minimum level, the fluid level switch closes the brake warning lamp circuit. This will turn on the red brake warning lamp. At this time, master cylinder fluid reservoir should be checked and filled to the full mark with DOT 3 brake fluid. **If brake fluid level has dropped in master cylinder fluid reservoir, the entire brake hydraulic system should be checked for evidence of a leak.**

**RED BRAKE WARNING LAMP****DESCRIPTION**

The red BRAKE warning lamp is located in the instrument panel cluster and is used to indicate a low brake fluid condition, the parking brake being applied or that the antilock brake system has a fault but could not turn on the amber ABS warning lamp. In addition, the brake warning lamp is turned on as a bulb check by the ignition switch when the ignition switch is placed in the crank position.

**OPERATION**

The warning lamp bulb is supplied a 12-volt ignition feed anytime the ignition switch is on. The bulb is then illuminated by completing the ground circuit either through the fluid level switch in the master cylinder reservoir, the parking brake warning lamp switch mounted on the parking brake lever, the ignition switch when in the crank position or by the mechanical instrument cluster in the situation when the ABS CAB cannot illuminate the amber ABS warning lamp.

**DIAGNOSIS AND TESTING****BASE BRAKE SYSTEM DIAGNOSIS CHARTS**

**NOTE:** There are three diagnosis charts following that cover the RED BRAKE WARNING LAMP, BRAKE NOISE and OTHER BRAKE CONDITIONS.

**DIAGNOSIS AND TESTING (Continued)****RED BRAKE WARNING LAMP**

CONDITION	POSSIBLE CAUSES	CORRECTION
RED BRAKE WARNING LAMP ON	<ol style="list-style-type: none"> <li>1. Parking brake lever not fully released.</li> <li>2. Parking brake warning lamp switch on parking brake lever.</li> <li>3. Brake fluid level low in reservoir.</li> <li>4. Brake fluid level switch.</li> <li>5. Mechanical instrument cluster (MIC) problem.</li> </ol>	<ol style="list-style-type: none"> <li>1. Release parking brake lever.</li> <li>2. Inspect and replace switch as necessary.</li> <li>3. Fill reservoir. Check entire system for leaks. Repair or replace as required.</li> <li>4. Disconnect switch wiring connector. If lamp goes out, replace switch.</li> <li>5. Refer to Chassis Diagnostic Procedures manual.</li> </ol>

**BRAKE NOISE**

CONDITION	POSSIBLE CAUSES	CORRECTION
DISC BRAKE CHIRP	<ol style="list-style-type: none"> <li>1. Excessive brake rotor runout.</li> <li>2. Lack of lubricant on brake caliper slides.</li> </ol>	<ol style="list-style-type: none"> <li>1. Follow brake rotor diagnosis and testing. Correct as necessary.</li> <li>2. Lubricate brake caliper slides.</li> </ol>
DISC BRAKE RATTLE OR CLUNK	<ol style="list-style-type: none"> <li>1. Broken or missing anti-rattle spring clips on shoes.</li> <li>2. Caliper guide pins loose.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace brake shoes.</li> <li>2. Tighten guide pins.</li> </ol>
DISC BRAKE SQUEAK AT LOW SPEED (WHILE APPLYING LIGHT BRAKE PEDAL EFFORT)	<ol style="list-style-type: none"> <li>1. Brake shoe linings.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace brake shoes.</li> </ol>
DRUM BRAKE CHIRP	<ol style="list-style-type: none"> <li>1. Lack of lubricant on brake shoe support plate where shoes ride.</li> <li>2. Wheel cylinder out of alignment.</li> </ol>	<ol style="list-style-type: none"> <li>1. Lubricate shoe contact areas on brake shoe support plates.</li> <li>2. Loosen wheel cylinder mounting bolts, realign wheel cylinder with brake shoes and tighten mounting bolts.</li> </ol>
DRUM BRAKE CLUNK	<ol style="list-style-type: none"> <li>1. Drum(s) have threaded machined braking surface.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reface or replace brake drums as necessary.</li> </ol>
DRUM BRAKE HOWL OR MOAN	<ol style="list-style-type: none"> <li>1. Lack of lubricant on brake shoe support plate where shoes ride and at the anchor.</li> <li>2. Rear brake shoes.</li> </ol>	<ol style="list-style-type: none"> <li>1. Lubricate shoe contact areas on brake shoe support plates and at the anchor.</li> <li>2. Replace rear brake shoes.</li> </ol>
DRUM BRAKE SCRAPING OR WHIRRING	<ol style="list-style-type: none"> <li>1. ABS wheel speed sensor or tone wheel.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inspect, correct or replace faulty component(s).</li> </ol>
SCRAPING (METAL-TO-METAL).	<ol style="list-style-type: none"> <li>1. Foreign object interference with brakes.</li> <li>2. Brake shoes worn out.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inspect brakes and remove foreign object.</li> <li>2. Replace brake shoes. Inspect rotors and drums. Reface or replace as necessary.</li> </ol>

**DIAGNOSIS AND TESTING (Continued)****OTHER BRAKE CONDITIONS**

CONDITION	POSSIBLE CAUSES	CORRECTION
BRAKES CHATTER	1. Rear brake drum out of round or disc brake rotor has excessive thickness variation.	1. Isolate condition as rear or front. Reface or replace brake drums or rotors as necessary.
BRAKES DRAG (FRONT OR ALL)	1. Contaminated brake fluid. 2. Binding caliper pins or bushings. 3. Binding master cylinder. 4. Binding brake pedal.	1. Check for swollen seals. Replace all system components containing rubber. 2. Replace pins and bushings 3. Replace master cylinder. 4. Replace brake pedal.
BRAKES DRAG (REAR ONLY)	1. Parking brake cables binding or froze up. 2. Parking brake cable return spring not returning shoes. 3. Service brakes not adjusted properly (rear drum brakes only). 4. Obstruction inside the center console preventing full return of the parking brake cables.	1. Check cable routing. Replace cables as necessary. 2. Replace cables as necessary. 3. Follow the procedure listed in the adjustment section. 4. Remove console and remove obstruction.
BRAKES GRAB	1. Contaminated brake shoe linings. 2. Improper power brake booster assist.	1. Inspect and clean, or replace shoes. Repair source of contamination. 2. Refer to power brake booster in the diagnosis and testing section.
EXCESSIVE PEDAL EFFORT	1. Obstruction of brake pedal. 2. Low power brake booster assist. 3. Glazed brake linings. 4. Brake shoe lining transfer to brake rotor.	1. Inspect, remove or move obstruction. 2. Refer to power brake booster in the diagnosis and testing section. 3. Reface or replace brake rotors as necessary. Replace brake shoes. 4. Reface or replace brake rotors as necessary. Replace brake shoes.
EXCESSIVE PEDAL TRAVEL (VEHICLE STOPS OK)	1. Air in brake lines. 2. Rear drum brake auto-adjuster malfunctioning.	1. Bleed brakes. 2. Inspect and replace drum brake components as necessary. Adjust rear brakes.
EXCESSIVE PEDAL TRAVEL (PEDAL GOES TO FLOOR - CAN'T SKID WHEELS)	1. Power brake booster runout (vacuum assist).	1. Check booster vacuum hose and engine tune for adequate vacuum supply. Refer to power brake booster in the diagnosis and testing section.
EXCESSIVE PEDAL TRAVEL (ONE FRONT WHEEL LOCKS UP DURING HARD BRAKING)	1. One of the two hydraulic circuits to the front brakes is malfunctioning.	1. Inspect system for leaks. Check master cylinder for internal malfunction.



**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSES	CORRECTION
PEDAL PULSATES/ SURGES DURING BRAKING	1. Rear brake drum out of round or disc brake rotor has excessive thickness variation.	1. Isolate condition as rear or front. Reface or replace brake drums or rotors as necessary.
PEDAL IS SPONGY	1. Air in brake lines. 2. Power brake booster runout (vacuum assist).	1. Bleed brakes. 2. Check booster vacuum hose and engine tune for adequate vacuum supply. Refer to power brake booster in the diagnosis and testing section.
PREMATURE REAR WHEEL LOCKUP	1. Contaminated brake shoe linings. 2. Inoperative proportioning valve. 3. Improper power brake booster assist.	1. Inspect and clean, or replace shoes. Repair source of contamination. 2. Test proportioning valves following procedure listed in diagnosis and testing section. Replace valves as necessary. 3. Refer to power brake booster in the diagnosis and testing section.
STOP LAMPS STAY ON	1. Brake lamp switch out of adjustment. 2. Brake pedal binding. 3. Obstruction in pedal linkage. 4. Power Brake Booster not allowing pedal to return completely.	1. Adjust brake lamp switch. 2. Inspect and replace as necessary. 3. Remove obstruction. 4. Replace power brake booster.
VEHICLE PULLS TO RIGHT OR LEFT ON BRAKING	1. Frozen brake caliper piston. 2. Contaminated brake shoe lining. 3. Pinched brake lines. 4. Leaking piston seal. 5. Suspension problem.	1. Replace frozen piston or caliper. Bleed brakes. 2. Inspect and clean, or replace shoes. Repair source of contamination. 3. Replace pinched line. 4. Replace piston seal or brake caliper. 5. Refer to the Suspension group.
PARKING BRAKE - EXCESSIVE HANDLE TRAVEL	1. Rear drum brakes or parking brake shoes out of adjustment.	1. Adjust rear drum brake shoes, or rear parking brake shoes on vehicles with rear disc brakes.

**POWER BRAKE BOOSTER****BASIC TEST**

(1) With engine off, depress and release the brake pedal several times to purge all vacuum from the power brake booster.

(2) Depress and hold the pedal with light effort (15 to 25 lbs. pressure), then start the engine.

The pedal should fall slightly, then hold. Less effort should be needed to apply the pedal at this time. If the pedal fell as indicated, perform the VACUUM LEAK TEST listed after the BASIC TEST. If the

pedal did not fall, continue on with this BASIC TEST.

(3) Disconnect the vacuum hose on the side of the vacuum check valve that leads to the speed control, then connect a vacuum gauge to the open vacuum port on the valve.

(4) Start the engine.

(5) When the engine is at warm operating temperature, allow it to idle and check the vacuum at the gauge.

If the vacuum supply is 12 inches Hg (40.5 kPa) or more, the power brake booster is defective and must be replaced. If the vacuum supply is below 12 inches, continue on with this BASIC TEST.

**DIAGNOSIS AND TESTING (Continued)**

(6) Shut off the engine.

(7) Connect the vacuum gauge to the vacuum reference port on the engine intake manifold.

(8) Start the engine and observe the vacuum gauge.

If the vacuum is still low, check the engine tune and repair as necessary. If the vacuum is above 12 inches, the hose or check to the booster has a restriction or leak.

Once an adequate vacuum supply is obtained, repeat the BASIC TEST.

**VACUUM LEAK TEST**

(1) Disconnect the vacuum hose on the side of the power brake booster vacuum check valve that leads to the speed control, then connect a vacuum gauge to the open vacuum port on the valve.

(2) Remove the remaining hose on the vacuum check valve that is not the vacuum supply hose coming from the intake manifold. Cap off the open port on the check valve.

(3) Start the engine.

(4) Allow the engine to warm up to normal operating temperature and engine idle.

(5) Using vacuum line pliers, close off the vacuum supply hose near the booster and observe the vacuum gauge.

If the vacuum drop exceeds 1.0 inch Hg (3.3 kPa) in one minute, repeat the above steps to confirm the reading. The vacuum loss should be less than 1.0 inch Hg in one minute time span. If the loss is more than 1.0 inch Hg, replace the power brake booster. If it is not, continue on with this test.

(6) Remove the pliers from the hose temporarily.

(7) Apply light effort (approximately 15 lbs. of force) to the brake pedal and hold the pedal steady. Do not move the pedal once the pressure is applied or the test results may vary.

(8) Have an assistant reattach the pliers to the vacuum supply hose.

(9) Allow 5 seconds for stabilization, then observe the vacuum gauge.

If the vacuum drop exceeds 3.0 inches Hg (10 kPa) in 15 seconds, repeat the above steps to confirm the reading. The vacuum loss should be less than 3.0 inches Hg in 15 seconds time span. If the loss is more than 3.0 inches Hg, replace the power brake booster. If it is not, the booster is not defective.

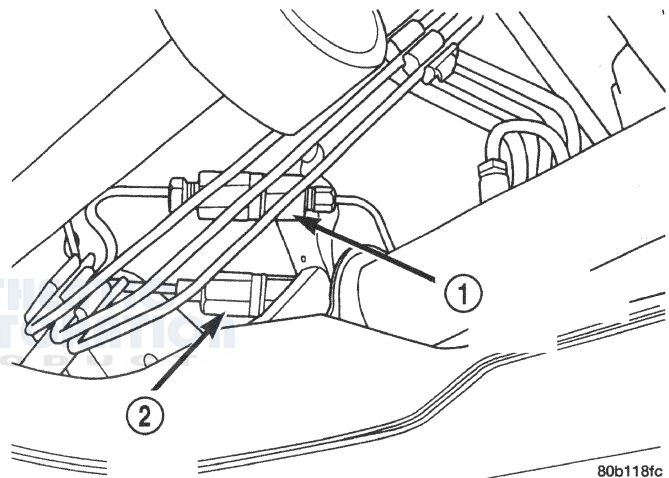
**PROPORTIONING VALVE**

**NOTE:** The following procedure is for the diagnosis and testing of the proportioning valve(s) on a vehicle without ABS. For diagnosis and testing of proportioning valves on a vehicle equipped with ABS,

Refer to the ANTILOCK BRAKE SYSTEM section in this group.

If a condition of premature rear wheel skid occurs on a vehicle, the proportioning valve should always be tested prior to it being replaced. This is due to the fact that there are conditions other than a faulty proportioning valve which can cause a premature rear wheel skid.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 21). Therefore, a road test to determine which rear brake slides first is essential. Once the wheel which slides first is determined, use the following procedure to diagnose the proportioning valve.



**Fig. 21 Non-ABS Brake Proportioning Valve Location**

- 1 - LEFT REAR PROPORTIONING VALVE
- 2 - RIGHT REAR PROPORTIONING VALVE

The test procedure for a premature rear wheel skid is the same for both rear wheel proportioning valves. After road testing vehicle to determine which wheel skids first, the proper test fittings required will have to be determined. Then follow the procedure below for testing the required proportioning valve.

(1) Road test the vehicle. Determine which rear wheel exhibits premature rear wheel skid, then refer to the figure (Fig. 21) to determine which proportioning valve needs to be tested.

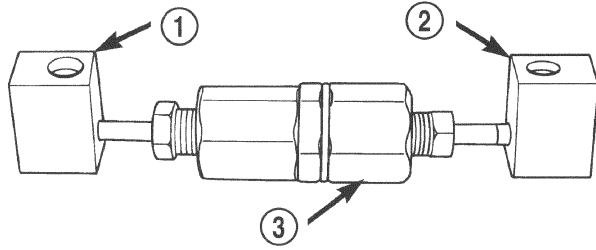
(2) Remove hydraulic brake line (Fig. 21) from proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

(3) Remove the proportioning valve from the rear brake chassis tube.

## DIAGNOSIS AND TESTING (Continued)

**CAUTION:** Be sure the pressure test fittings being installed into proportioning valve, have the correct thread sizes for installation into the proportioning valve and installation of rear brake line tube nut.

(4) Install Pressure Test Fitting, Special Tool 8187 in the inlet port of the proportioning valve (Fig. 22). Install Pressure Test Fitting, Special Tool 8187-2 in the outlet port of the proportioning valve (Fig. 22). Tighten tube nuts to a torque of 17 N·m (145 in. lbs.)

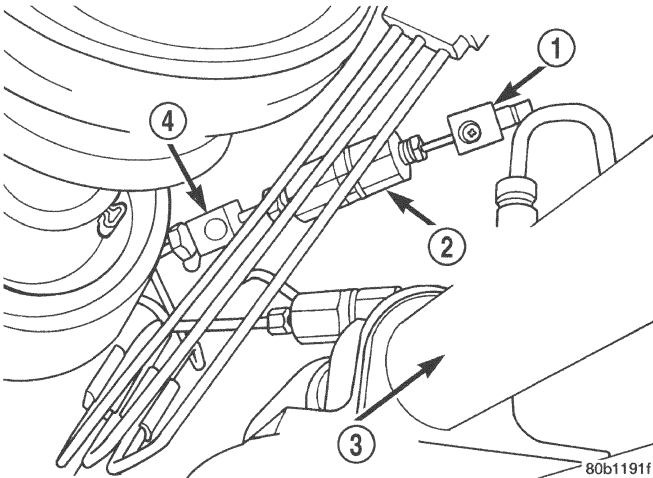


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**Fig. 22 Pressure Test Fitting Installed In Proportioning Valve**

- 1 - SPECIAL TOOL 8187
- 2 - SPECIAL TOOL 8187-2
- 3 - PROPORTIONING VALVE

(5) Install the proportioning valve with the pressure test fittings installed, in the chassis brake tube (Fig. 23). Tighten both tube nuts to a torque of 17 N·m (145 in. lbs.).

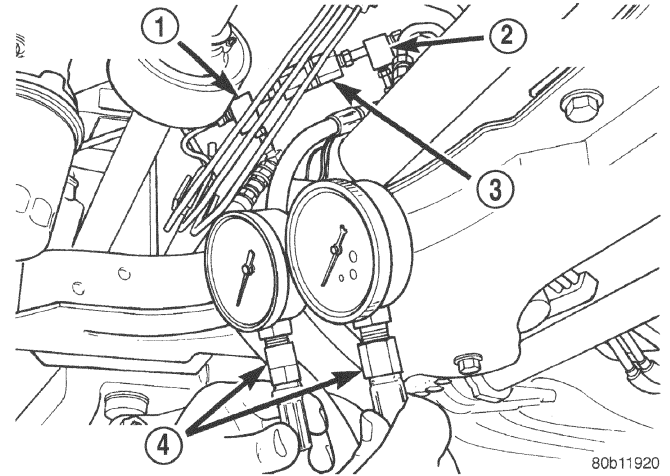


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**Fig. 23 Proportioning Valve With Pressure Test Fittings Installed**

- 1 - SPECIAL TOOL 8187-2
- 2 - PROPORTIONING VALVE
- 3 - STEERING GEAR
- 4 - SPECIAL TOOL 8187

(6) Install a Pressure Gauge, Special Tool C-4007-A into each pressure test fitting (Fig. 24). Bleed air out of hose from pressure test fitting to pressure gauge, at pressure gauge to remove all trapped air. hose.



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**Fig. 24 Pressure Gauges Installed On Pressure Test Fittings**

- 1 - PRESSURE TEST FITTING
- 2 - PRESSURE TEST FITTING
- 3 - PROPORTIONING VALVE
- 4 - SPECIAL TOOL C-4007-A

(7) With the aid of a helper, apply pressure to the brake pedal until reading on proportioning valve inlet gauge, is at the pressure shown on the following chart, PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS. Then check the pressure reading on the proportioning valve outlet gauge. If proportioning valve outlet pressure does not agree with value shown on the following chart, when inlet pressure shown on chart is obtained, replace the proportioning valve. If proportioning valve is within pressure specifications do not replace proportioning valve.

(8) Check rear wheel brake shoe linings for contamination or for replacement brake shoes not meeting OEM brake lining material specifications. These conditions can also be a possible cause for a premature rear wheel skid.

(9) Install proportioning valve in rear brake line and hand tighten both tube nuts until they are fully seated in proportioning valve.

(10) Tighten both brake line tube nuts at the proportioning valve to a torque of 17 N·m (145 in. lbs.).

(11) Bleed the affected brake line. Refer to BASE BRAKE BLEEDING in the SERVICE PROCEDURES section.



**DIAGNOSIS AND TESTING (Continued)****PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS**

Sales Code	Brake System Type	Split Point	Slope	Identification	Inlet Pressure	Outlet Pressure
BRA	14" Disc/Drum	600 psi	0.59	Bar Code Label	1000 psi	800-900 psi
BRJ	14" Disc/Drum W/ABS	600 psi	0.59	Bar Code Label	1000 psi	800-900 psi
BRF	14" Disc/Disc W/ABS	500 psi	0.43	Bar Code Label	1000 psi	600-700 psi

**BRAKE ROTOR**

Any servicing of the rotor requires extreme care to maintain the rotor within service tolerances to ensure proper brake action.

Excessive runout or wobble in a rotor can increase pedal travel due to piston knock-back. This increases guide pin sleeve wear due to the tendency of the caliper to follow the rotor wobble.

When diagnosing a brake noise or pulsation, the machined disc braking surface should be checked and inspected.

**BRAKING SURFACE INSPECTION**

Light braking surface scoring and wear is acceptable. If heavy scoring or warping is evident, the rotor must be refaced or replaced. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

Excessive wear and scoring of the rotor can cause improper lining contact on the rotor's braking surface. If the ridges on the rotor are not removed before new brake shoes are installed, improper wear of the shoes will result.

If a vehicle has not been driven for a period of time, the rotor's braking surface will rust in the areas not covered by the brake shoes at that time. Once the vehicle is driven, noise and chatter from the disc brakes can result when the brakes are applied.

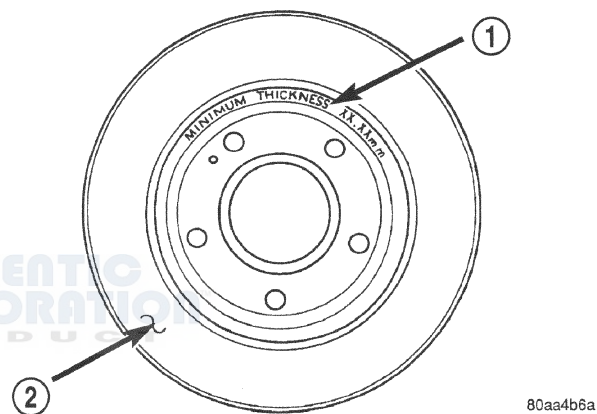
Some discoloration or wear of the rotor surface is normal and does not require resurfacing when linings are replaced. If cracks or burned spots are evident, the rotor must be replaced.

**ROTOR MINIMUM THICKNESS**

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if it is worn below minimum thickness or if machining the rotor will cause its thickness to fall below specifications.

**CAUTION:** Do not machine the rotor if it will cause the rotor to fall below minimum thickness.

Minimum thickness specifications are cast on the rotor's unmachined surface (Fig. 25). Limits can also be found in the table at the end of this brake rotor information.



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**Fig. 25 Minimum Brake Rotor Thickness Markings (Typical)**

- 1 – ROTOR MINIMUM THICKNESS MARKING  
2 – ROTOR

**ROTOR THICKNESS VARIATION**

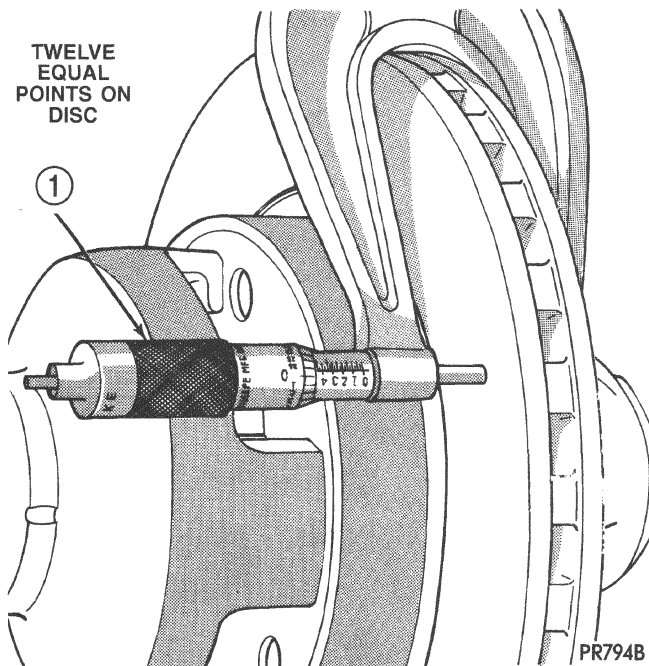
Thickness variation in a rotor's braking surface can result in pedal pulsation, chatter and surge. This can also be caused by excessive runout in the rotor or the hub.

Rotor thickness variation measurements should be made in conjunction with measuring runout. Measure thickness of the brake rotor at 12 equal points around the rotor braking surface with a micrometer at a radius approximately 25 mm (1 inch) from edge of rotor (Fig. 26). If thickness measurements vary by more than 0.013 mm (0.0005 inch), the rotor should be refaced or replaced. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

**ROTOR RUNOUT**

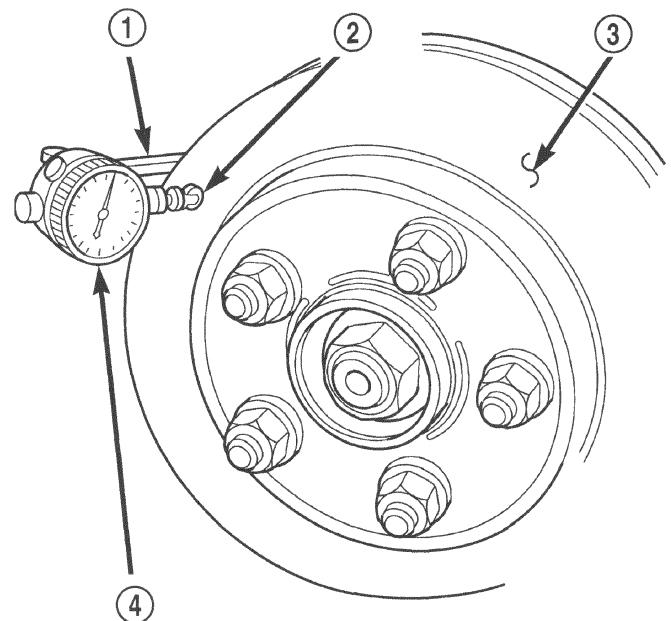
On-vehicle rotor runout is the combination of the individual runout of the hub face and the runout of the rotor. (The hub and rotor runouts are separable).

## DIAGNOSIS AND TESTING (Continued)



**Fig. 26 Checking Rotor For Thickness**

1 - CALIPER



**Fig. 27 Checking Rotor Runout**

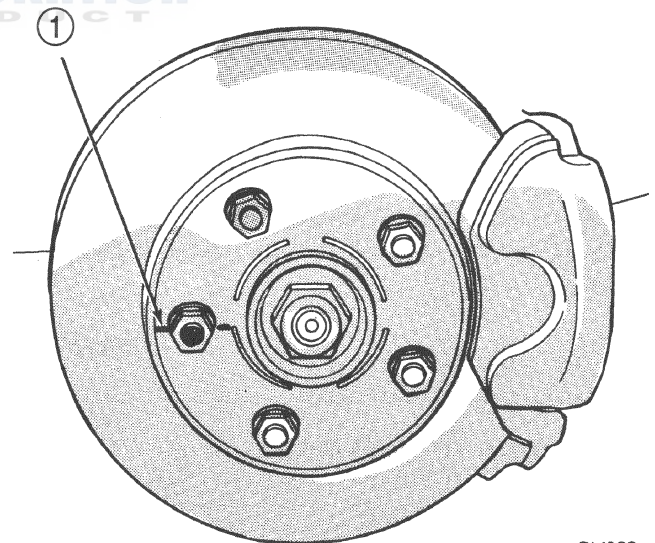
- 1 - SPECIAL TOOL SP-1910
- 2 - 25mm FROM EDGE
- 3 - DISC SURFACE
- 4 - SPECIAL TOOL C-3339

To measure rotor runout on the vehicle, first remove the tire and wheel assembly. Reinstall the wheel mounting nuts on the studs, tightening the rotor to the hub. Mount the Dial Indicator, Special Tool C-3339, with Mounting Adaptor, Special Tool SP-1910 on steering arm. The dial indicator plunger should contact braking surface of rotor approximately 25 mm (one inch) from outer edge of rotor (Fig. 27). Check lateral runout on both sides of the rotor, marking the low and high spots on both. Runout limits can be found in the table at the end of this brake rotor information.

If runout is in excess of the specification, check the lateral runout of the hub face. Before removing the rotor from the hub, place a chalk mark across both the rotor and the one wheel stud closest to where the high runout measurement was taken. This way, the original mounting spot of the rotor on the hub is indexed (Fig. 28).

Remove the rotor from the hub.

**NOTE:** Clean the hub face surface before checking runout. This provides a clean surface to get an accurate indicator reading.



**Fig. 28 Marking Rotor and Wheel Stud**

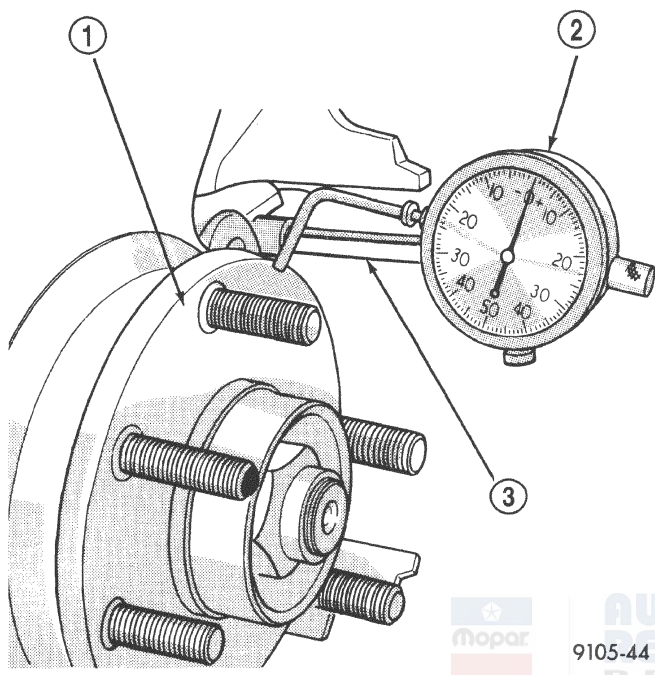
1 - CHALK MARK

RN199



**DIAGNOSIS AND TESTING (Continued)**

Mount Dial Indicator, Special Tool C-3339, and Mounting Adaptor, Special Tool SP-1910, to the steering knuckle. Position the indicator stem so it contacts the hub face near the outer diameter. Care must be taken to position stem outside of the stud circle, but inside of the chamfer on the hub rim (Fig. 29).

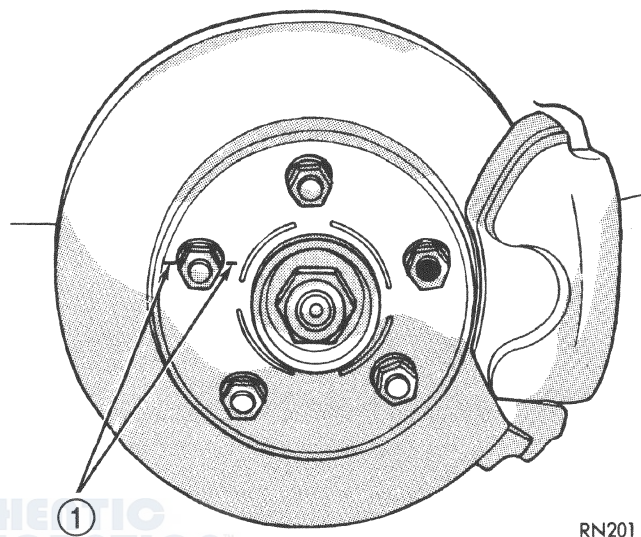
**Fig. 29 Checking Hub Runout**

- 1 - HUB SURFACE
- 2 - SPECIAL TOOL C-3339
- 3 - SPECIAL TOOL SP-1910

Hub runout should not exceed 0.08 mm (0.003 inch). If runout exceeds this specification, the hub

must be replaced. Refer to the SUSPENSION group in this service manual for the hub and bearing removal and installation procedure.

If the hub runout does not exceed this specification, install the rotor back on the hub, aligning the chalk marks on the rotor with a wheel mounting stud, two studs apart from the original stud (Fig. 30). Tighten nuts in the proper sequence and torque to specifications.



RN201

**Fig. 30 Index Rotor And Wheel Stud**

- 1 - CHALK MARK

Recheck brake rotor runout to see if the runout is now within specifications.

If runout is not within specifications, reface or replace the brake rotor. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

**BRAKE ROTOR LIMITS**

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Runout*	Rotor Micro Finish
Front Rotor	22.87–23.13 mm 0.900–0.911 in.	21.4 mm 0.843 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15–80 RMS
Rear Rotor	8.87–9.13 mm 0.350–0.360 in.	7.25 mm 0.285 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15–80 RMS

\* TIR Total Indicator Reading (Measured On Vehicle)

**BRAKE DRUM**

With the drum off the vehicle, measure the drum for diameter variation (oval shape). The diameter variation of the drum braking surface must not exceed either 0.0635 mm (0.0025 inch) in 30° or 0.0889 mm (0.0035 inch) in 360°.

Measure brake drum runout. Brake drum runout should be checked with the drum mounted on a brake lathe. Brake drum runout should not exceed 0.1524 mm (0.006 inch).

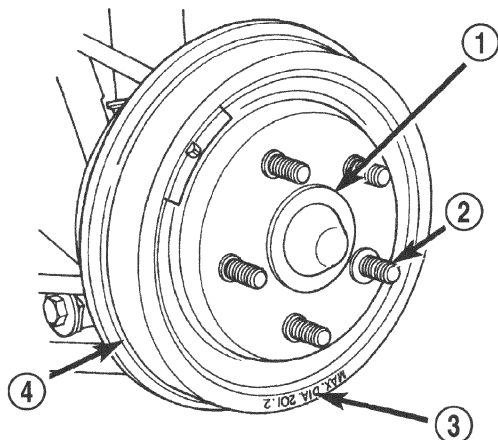
If either of these measurements are not within specification, reface or replace the drum. Refer to



## DIAGNOSIS AND TESTING (Continued)

**BRAKE DRUM MACHINING** in the SERVICE PROCEDURES section of this service manual group for refacing procedures.

Always replace the drum if machining will cause the diameter to exceed drum maximum diameter. All brake drums are marked with the maximum allowable brake drum diameter (Fig. 31).



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**Fig. 31 Brake Drum Maximum Diameter Identification**

- 1 - HUB/BEARING ASSEMBLY
- 2 - WHEEL MOUNTING STUDS
- 3 - BRAKE DRUM MAXIMUM DIAMETER MARKING
- 4 - REAR BRAKE DRUM

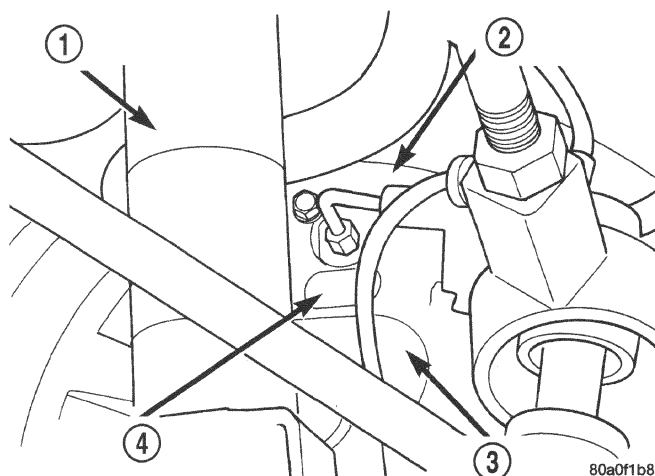
## DRUM BRAKE AUTOMATIC ADJUSTER

Place the vehicle on a frame contact hoist with a helper in the driver's seat to apply the brakes. Raise the vehicle. Remove the adjuster access hole plug, from the rear brake support plate (Fig. 32). This will allow access to the star wheel on the automatic adjuster mechanism. Then, to eliminate the possibility of maximum adjustment, insert a small screwdriver through the access hole in the support plate (Fig. 33) and back off the adjuster star wheel approximately 10 notches. **It will be necessary to hold the adjuster lever away from the star wheel to perform this adjustment procedure.**

Fully apply the brake pedal which will cause the brake shoes to leave the anchor. Upon application of the brake pedal, the adjuster lever should move downward, turning the star wheel on the adjuster. Thus, a definite rotation of the adjuster star wheel can be observed if the automatic adjuster is working properly. If one or more adjusters do not function properly, the respective brake drum must be removed for servicing of the adjuster mechanism.

## BRAKE FLUID CONTAMINATION

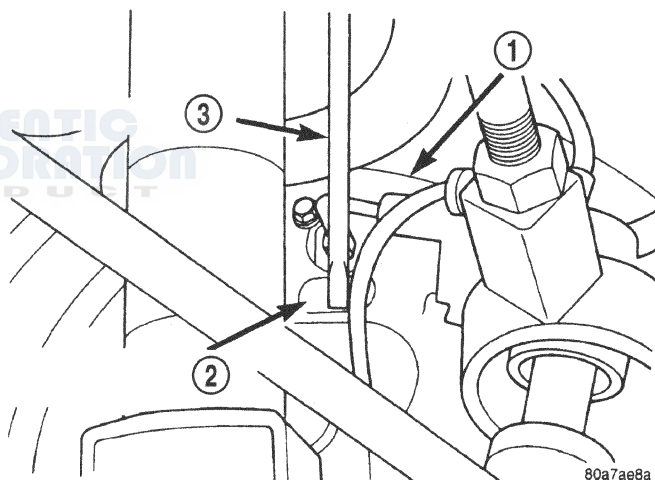
Indications of fluid contamination are swollen or deteriorated rubber parts.



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**Fig. 32 Adjuster Access Hole Plug**

- 1 - SHOCK ABSORBER
- 2 - BRAKE SUPPORT PLATE
- 3 - KNUCKLE
- 4 - BRAKE ADJUSTER ACCESS HOLE PLUG



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**Fig. 33 Accessing The Automatic Adjuster**

- 1 - BRAKE SUPPORT PLATE
- 2 - BRAKE ADJUSTER ACCESS HOSE
- 3 - SCREWDRIVER

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

**DIAGNOSIS AND TESTING (Continued)****BRAKE LAMP SWITCH**

The required procedure for testing the brake lamp switch is covered in GROUP 8H - VEHICLE SPEED CONTROL SYSTEM in this service manual. The electrical circuit for brake lamps is covered in GROUP 8W - REAR LIGHTING in this service manual.

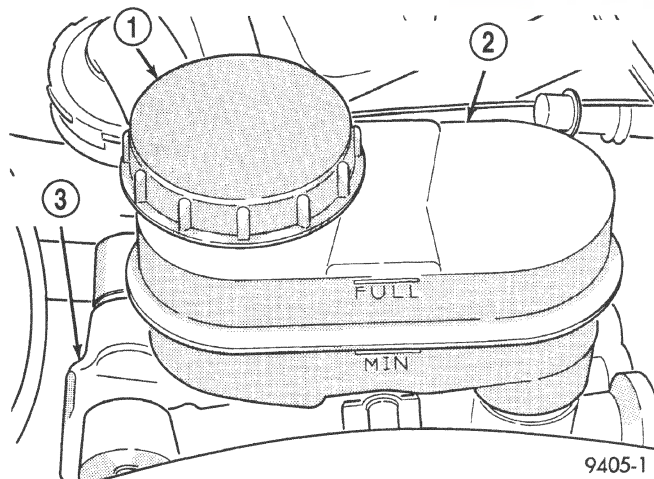
**SERVICE PROCEDURES****BRAKE FLUID LEVEL CHECKING**

Brake fluid level should be checked a minimum of twice a year.

Master cylinder reservoirs are marked, FULL and MIN, indicating the allowable brake fluid level range in the master cylinder brake fluid reservoir (Fig. 34).

**CAUTION: Use only Mopar® brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.**

Although there is a range, the preferred level is FULL. If necessary, adjust the brake fluid level, bringing it to the FULL mark on the side of the master cylinder brake fluid reservoir.



**Fig. 34 Master Cylinder Fluid Level**

- 1 - CAP
- 2 - MASTER CYLINDER BRAKE FLUID RESERVOIR
- 3 - MASTER CYLINDER

**BASE BRAKE BLEEDING**

**NOTE: For bleeding the ABS hydraulic system, refer to ANTILOCK BRAKE SYSTEM BLEEDING in the ANTILOCK BRAKE SYSTEM section of this service manual group.**

**CAUTION: Before removing the master cylinder cap, wipe it clean to prevent dirt and other foreign matter from dropping into the master cylinder reservoir.**

**CAUTION: Use only Mopar® brake fluid or an equivalent from a fresh, tightly sealed container. Brake fluid must conform to DOT 3 specifications.**

Do not pump the brake pedal at any time while having a bleeder screw open during the bleeding process. This will only increase the amount of air in the system and make additional bleeding necessary.

Do not allow the master cylinder reservoir to run out of brake fluid while bleeding the system. An empty reservoir will allow additional air into the brake system. Check the fluid level frequently and add fluid as needed.

The following wheel circuit sequence for bleeding the brake hydraulic system should be used to ensure adequate removal of all trapped air from the hydraulic system.

- Left rear wheel
- Right front wheel
- Right rear wheel
- Left front wheel

**MANUAL BLEEDING**

**NOTE: To bleed the brakes manually, the aid of a helper will be required.**

(1) Attach a clear plastic hose to the bleeder screw and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 35).

(2) Have a helper pump the brake pedal three or four times and hold it in the down position.

(3) With the pedal in the down position, open the bleeder screw at least 1 full turn.

(4) Once the brake pedal has dropped, close the bleeder screw. After the bleeder screw is closed, release the brake pedal.

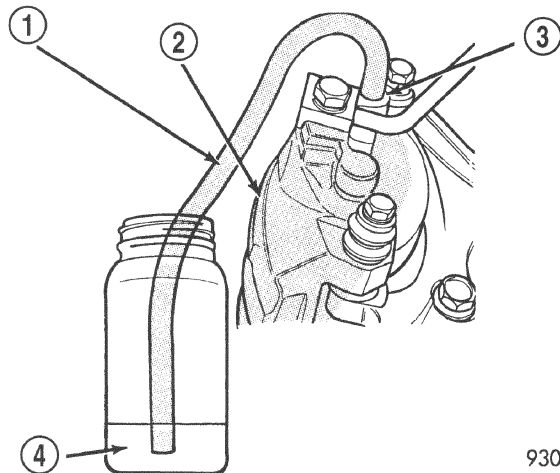
(5) Repeat the above steps until all trapped air is removed from that wheel circuit (usually four or five times).

(6) Bleed the remaining wheel circuits in the same manner until all air is removed from the brake system. Monitor the fluid level in the master cylinder reservoir to make sure it does not go dry.

(7) Check the brake pedal travel. If pedal travel is excessive or has not been improved, some air may still be trapped in the system. Rebleed the brakes as necessary.

(8) Test drive the vehicle to verify the brakes are operating properly and pedal feel is correct.

## SERVICE PROCEDURES (Continued)



**Fig. 35 Proper Method for Purging Air From Brake System (Typical)**

- 1 - CLEAR HOSE
- 2 - BRAKE CALIPER
- 3 - BLEEDER SCREW
- 4 - CLEAN BRAKE FLUID

## PRESSURE BLEEDING

**NOTE:** Follow pressure bleeder manufacturer's instructions for use of pressure bleeding equipment.

Use bleeder tank, Special Tool C-3496-B, with master cylinder reservoir adapter, Special Tool 8224, to pressurize the hydraulic system for bleeding.

Following the same wheel circuit sequence as prescribed for manual bleeding.

(1) Attach a clear plastic hose to the bleeder screw and feed the hose into a clear jar containing enough fresh brake fluid to submerge the end of the hose (Fig. 35).

(2) Open the bleeder screw at least one full turn or more to obtain a steady stream of brake fluid.

(3) After approximately 4–8 ounces of fluid have been bled through the brake circuit and an air-free flow is maintained in the clear plastic hose and jar, close the bleeder screw.

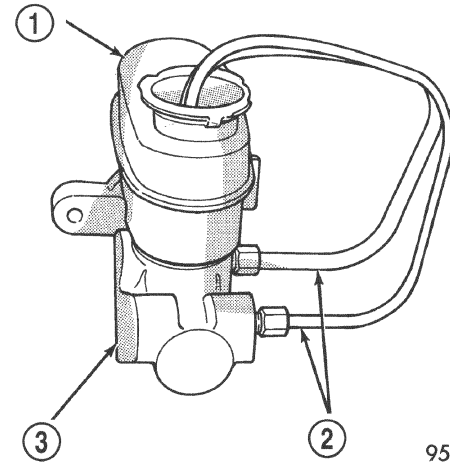
(4) Repeat this procedure at all the remaining bleeder screws.

(5) Check the brake pedal travel. If pedal travel is excessive or has not been improved, some air may still be trapped in the system. Rebleed the brakes as necessary.

(6) Test drive the vehicle to verify the brakes are operating properly and pedal feel is correct.

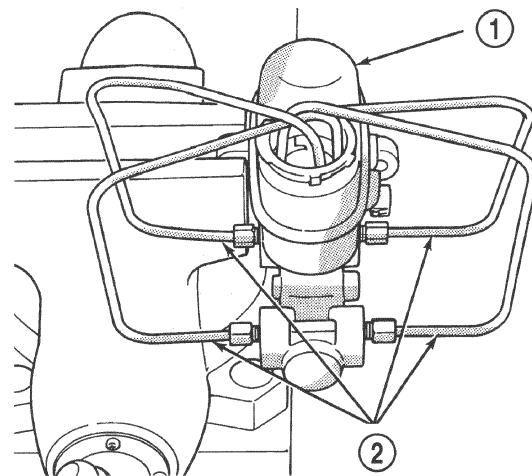
## MASTER CYLINDER BLEEDING

(1) Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool 6802 to the master cylinder outlet ports (Fig. 36) or (Fig. 37). Position bleeding tubes so the outlets of the bleeding tubes will be below the surface of the brake fluid when reservoir is filled to proper level.



**Fig. 36 Bleeding Tubes Attached To Master Cylinder With ABS**

- 1 - MASTER CYLINDER FLUID RESERVOIR
- 2 - SPECIAL TOOL 6802
- 3 - MASTER CYLINDER



**Fig. 37 Bleeding Tubes Attached to Master Cylinder With Out ABS**

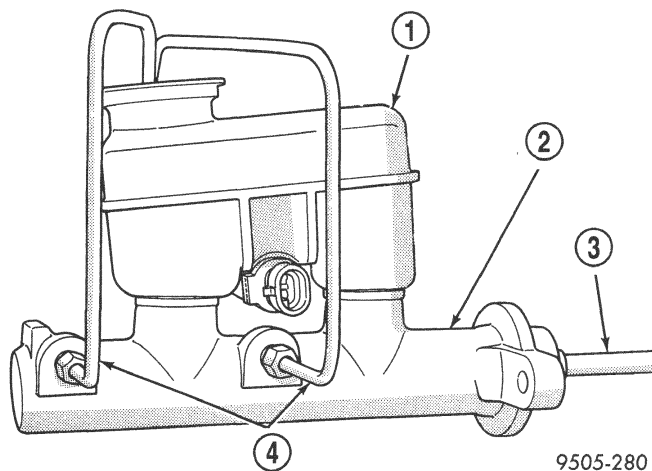
- 1 - MASTER CYLINDER ASSEMBLY
- 2 - SPECIAL TOOL 6802



## SERVICE PROCEDURES (Continued)

(2) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(3) Using a wooden dowel per (Fig. 38). Depress push rod slowly, and then allow pistons to return to the released position. Continue to repeat this step several times after no more air bubbles are expelled from bleed tubes to ensure all air is bled from the master cylinder.



**Fig. 38 Bleeding Master Cylinder**

- 1 - BRAKE FLUID RESERVOIR
- 2 - MASTER CYLINDER
- 3 - WOODEN DOWEL
- 4 - SPECIAL TOOL 6802

(4) Remove bleeding tubes from master cylinder outlet ports, plug outlet ports and install fill cap on reservoir.

(5) Remove master cylinder from vise.

**NOTE:** Note: It is not necessary to bleed the brakes entire hydraulic system after replacing the master cylinder. However, the master cylinder must have been thoroughly bled and filled to the proper level upon installation on the power brake vacuum booster.

## BRAKE TUBE REPAIR

This vehicle use two different size master cylinder brake tubes.

The master cylinder brake tubes used on this vehicle are different sizes. Vehicles that are not equipped with antilock brakes use double wall 4.75 mm (3/16 in.) brake tubes at all four port on the master cylinder. On vehicles equipped with antilock brakes, the master cylinder brakes tubes between the master cylinder and the antilock brake hydraulic control unit are 6.00 mm (1/4 in.).

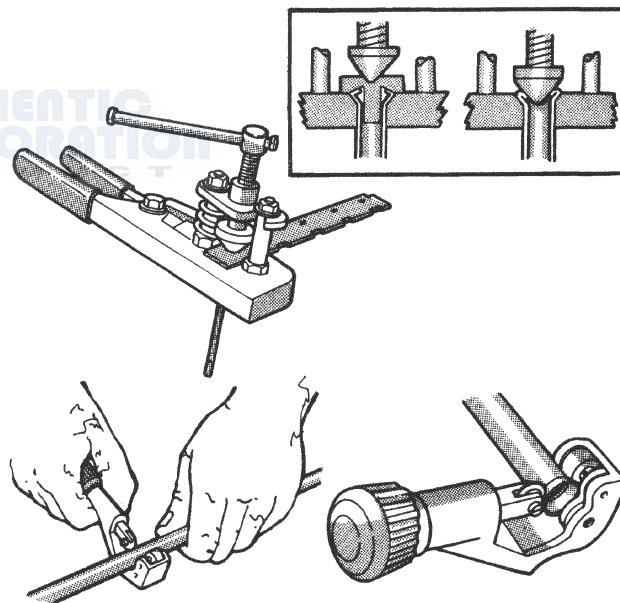
The chassis brake tubes used on all vehicles is double wall 4.75mm (3/16 in.) steel tubing.

When replacing or repairing chassis brake tubes on this vehicle be sure that the correct size and type of tube nuts are to be used for replacement of a hydraulic brake tube.

All chassis brake tubes used on this vehicle are coated with Al-rich/ZN-AL alloy coating to prevent corrosion of the brake tubes.

Care should be taken when repairing brake tubing, to be sure the proper bending and flaring tools and procedures are used, to avoid kinking. Do not route the tubes against sharp edges, moving components or into hot areas. All tubes should be properly attached with recommended retaining clips.

Using Tubing Cutter, Special Tool C-3478-A or equivalent, cut off damaged seat or tubing (Fig. 39). Ream out any burrs or rough edges showing on inside of tubing (Fig. 40). This will make the ends of tubing square (Fig. 40) and ensure better seating of flared end tubing. **PLACE TUBE NUT ON TUBING BEFORE FLARING THE TUBING.**



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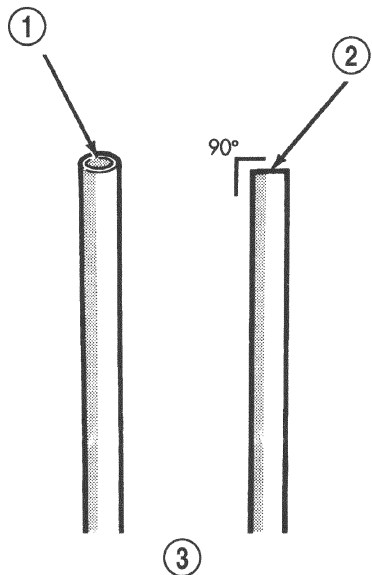
**Fig. 39 Cutting And Flaring Of Brake Fluid Tubing**

## DOUBLE INVERTED TUBING FLARES

To make a double inverted tubing flare (Fig. 41) and (Fig. 42). Open handles of Flaring Tool, Special Tool C-4047 or equivalent. Then rotate jaws of tool until the mating jaws of tubing size are centered between vertical posts on tool. Slowly close handles with tubing inserted in jaws but do not apply heavy pressure to handle as this will lock tubing in place.

Place gauge (Form A) on edge over end of brake tubing. Push tubing through jaws until end of tubing contacts the recessed notch in gauge matching the

## SERVICE PROCEDURES (Continued)

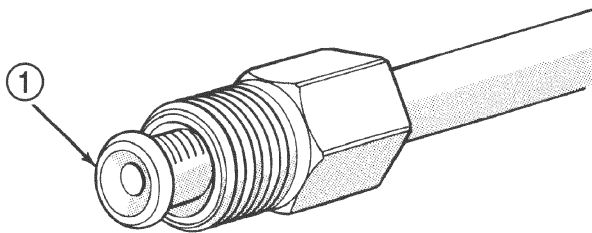


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**Fig. 40 Brake Fluid Tube Preparation For Flaring**

- 1 - BE SURE ALL BURRS ARE REMOVED FROM INSIDE OF TUBING
- 2 - BE SURE END OF TUBING IS SQUARE BEFORE FLARING TUBE
- 3 - HYDRAULIC BRAKE LINE TUBING

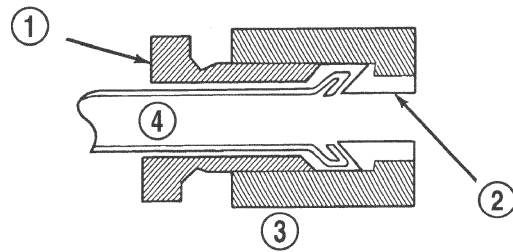
tubing size. Squeeze handles of flaring tool and lock tubing in place. Place the proper size plug in end of tubing. Swing compression disc over gauge and center tapered flaring screw in recess of disc. Screw in until plug gauge has seated on jaws of flaring tool. This action has started to invert the extended end of the tubing. Remove gauge and continue to screw down until tool is firmly seated in tubing. Remove tubing from flaring tool and inspect seat. Refer to tube routing diagrams for proper brake tube routing and clip locations. Replace any damaged tube routing clips.



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**Fig. 41 Double Inverted Brake Line Tubing Flare**

- 1 - DOUBLE INVERTED-STYLE FLARE



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**Fig. 42 Double Wall Inverted Flare Connection**

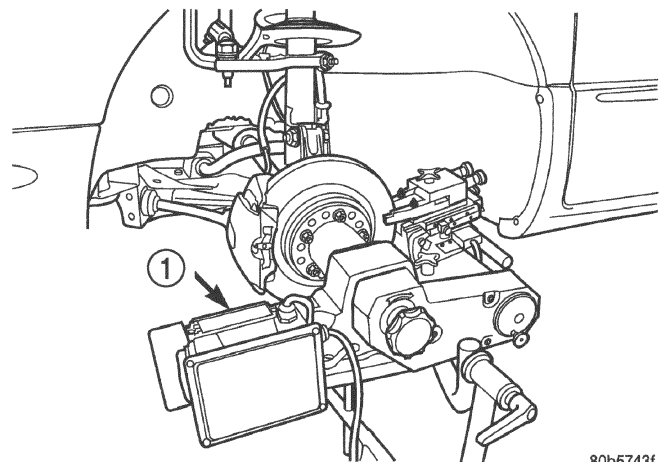
- 1 - INVERTED FLARE TUBE NUT
- 2 - SEAT
- 3 - INVERTED DOUBLE FLARE
- 4 - TUBE

## BRAKE ROTOR MACHINING

**NOTE:** Refacing the rotor is not required each time the brake pads are replaced, only when the need is foreseen.

Any servicing of the rotor requires extreme care to maintain the rotor within service tolerances to ensure proper brake action.

If the rotor surface is deeply scored or warped, or there is a complaint of brake roughness or brake pedal pulsation, the rotor should be refaced using a hub-mounted on-car brake lathe (Fig. 43), or replaced.



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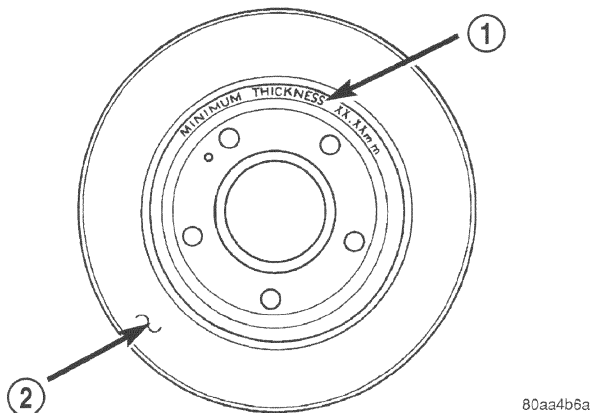
**Fig. 43 On-Car Brake Lathe**

- 1 - ON-CAR BRAKE LATHE

The use of a hub-mounted on-car brake lathe is highly recommended to eliminate the possibility of excessive runout. It trues the brake rotor to the vehicle's hub and bearing.

**SERVICE PROCEDURES (Continued)**

**NOTE:** All rotors have markings for minimum allowable thickness cast on an un-machined surface of the rotor (Fig. 44).



**Fig. 44 Minimum Brake Rotor Thickness Markings (Typical)**

- 1 - ROTOR MINIMUM THICKNESS MARKING  
2 - ROTOR

Minimum allowable thickness is the minimum thickness which the brake rotor machined surface may be cut to.

**CAUTION:** Do not machine the rotor if it will cause the rotor to fall below minimum thickness.

Before installation, verify the brake rotor face and the hub adapters are free of any chips, rust, or contamination.

When mounting and using the brake lathe, strict attention to the brake lathe manufacturer's operating instructions is required.

Machine both sides of the brake rotor at the same time. Cutting both sides at the same time minimizes the possibility of a tapered or uneven cut.

**SPECIFICATIONS AND LIMITS**

When refacing a rotor, the required TIR (Total Indicator Reading) and thickness variation limits **MUST BE MAINTAINED**. Extreme care in the operation of rotor turning equipment is required.

**BRAKE ROTOR REFINISHING LIMITS**

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Run Out*	Rotor Micro Finish
Front Rotor	22.87–23.13 mm 0.900-0.911 in.	21.4 mm 0.843 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15-80 RMS
Rear Rotor	8.87–9.13 mm 0.350-0.360 in.	7.25 mm 0.285 in.	0.013 mm 0.0005 in.	0.13 mm 0.005 in.	15-80 RMS
* TIR Total Indicator Reading (Measured On Vehicle)					

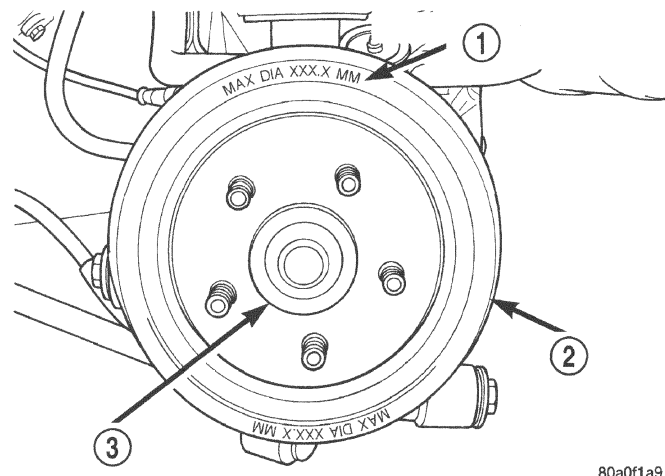
**BRAKE DRUM MACHINING**

If a brake drum is deeply scored or warped, it can be machined on a brake lathe equipped to machine brake drums. Follow the manufacturers instructions on the machining procedure.

Measure the brake drum diameter before machining. Refer to BRAKE DRUM in DIAGNOSIS AND TESTING in this section for further information. If machining the drum will cause the drum to exceed maximum diameter, do not machine the brake drum. It needs to be replaced.

All brake drums are marked with the maximum allowable brake drum diameter (Fig. 45).

When machining, make sure the final finish feed cut is fine in order to avoid a screw effect on the brake shoes when the brakes are applied. This final feed cut specification varies from lathe manufacturer to lathe manufacturer.



**Fig. 45 Brake Drum Maximum Diameter Identification**

- 1 - MAXIMUM DIAMETER MARKING  
2 - REAR BRAKE DRUM  
3 - HUB/BEARING ASSEMBLY



## REMOVAL AND INSTALLATION

### SERVICE WARNINGS AND CAUTIONS

**WARNING:** ALTHOUGH FACTORY INSTALLED BRAKE SHOE LININGS ARE MADE FROM ASBESTOS-FREE MATERIALS, SOME AFTERMARKET BRAKE SHOE LININGS MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM. IT IS POSSIBLE THAT AFTERMARKET BRAKE SHOES MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS; ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR; USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER-DAMPENED SHOP TOWELS. DO NOT CREATE BRAKE LINING DUST BY SANDING THE BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS. USE ONLY SEALED AIRTIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSING OF PRODUCTS CONTAINING ASBESTOS.

**CAUTION:** Use only Mopar® brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

**CAUTION:** Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash it off immediately with water.

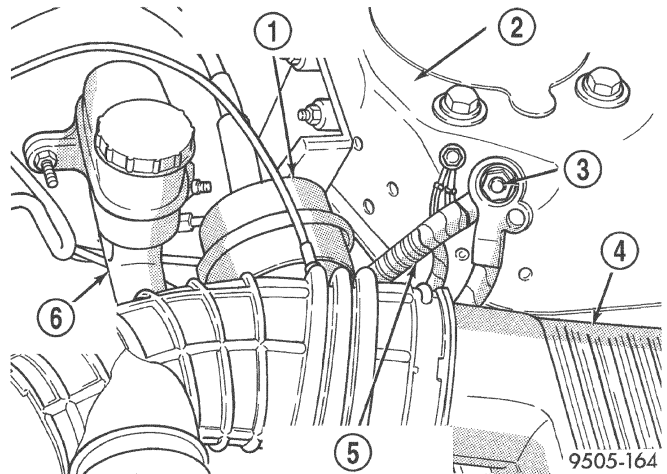
**CAUTION:** During service procedures, grease or any other foreign material must be kept off the caliper assembly, surfaces of the brake rotor and external surfaces of the hub. Avoid deformation, scratching or nicking of the brake rotor and brake shoe linings.

**CAUTION:** When handling the brake rotor and caliper, be careful to avoid damaging the rotor and caliper, and scratching or nicking the brake shoe lining.

## BRAKE PEDAL

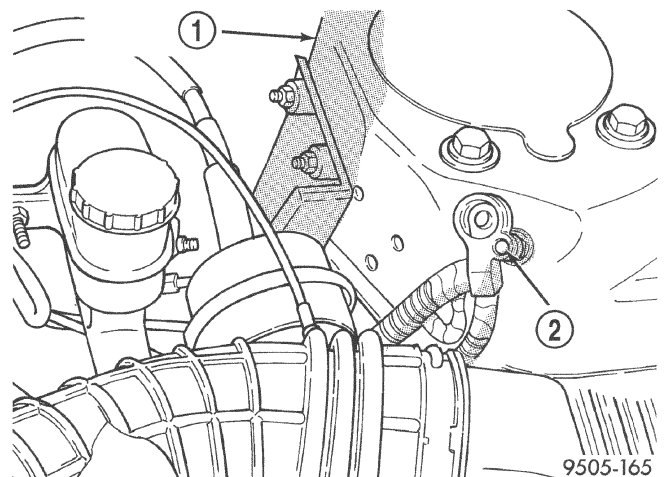
### REMOVAL

(1) Remove the remote ground cable from the ground stud located on the left strut tower (Fig. 46). Correctly isolate remote ground by installing the ground cable insulator on the strut tower ground stud as shown (Fig. 47)



**Fig. 46 Ground Cable Attachment At Strut Tower**

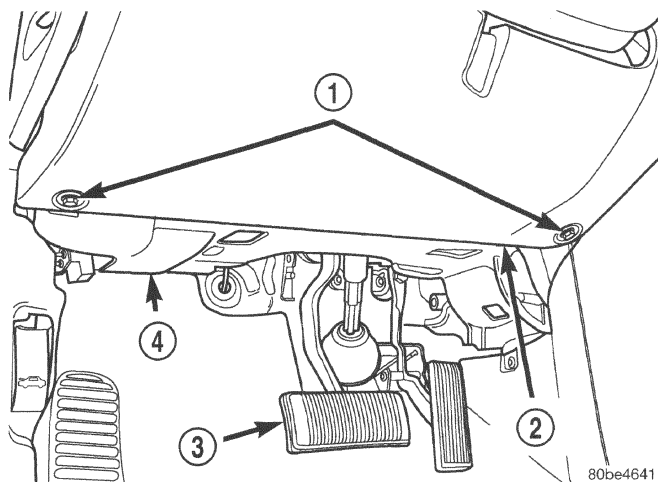
- 1 - SPEED CONTROL SERVO
- 2 - LEFT STRUT TOWER
- 3 - GROUND STUD
- 4 - AIR CLEANER
- 5 - REMOTE GROUND CABLE
- 6 - MASTER CYLINDER



**Fig. 47 Correctly Isolated Remote Ground Cable**

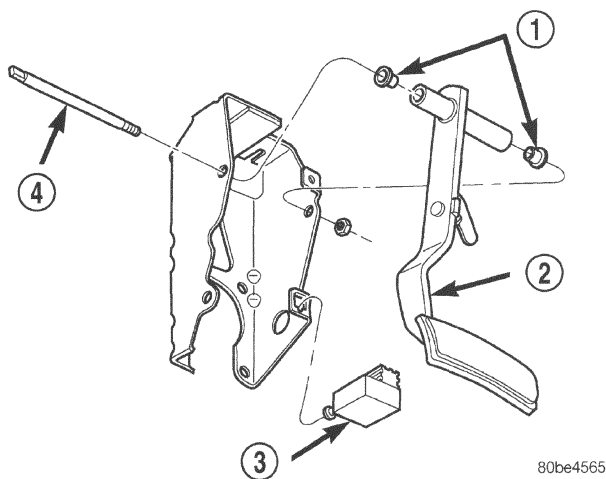
- 1 - LEFT STRUT TOWER
- 2 - GROUND STUD

(2) Remove the two screw securing the bottom of the knee bolster below the steering column in place (Fig. 48).

**REMOVAL AND INSTALLATION (Continued)****Fig. 48 Knee Bolster Screws**

- 1 - SCREWS
- 2 - KNEE BOLSTER
- 3 - BRAKE PEDAL
- 4 - HEAT DISTRIBUTION DUCT

(3) Remove the heat distribution duct (Fig. 48).  
 (4) Remove the brake lamp switch from its bracket (Fig. 49). The brake lamp switch is removed by depressing and holding the brake pedal while rotating brake lamp switch in a counter-clockwise direction approximately 30 degrees.

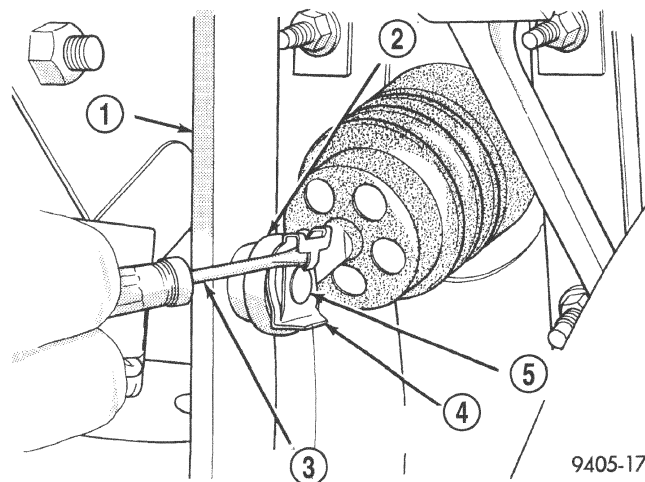
**Fig. 49 Brake Pedal Mounting**

- 1 - BUSHINGS
- 2 - BRAKE PEDAL
- 3 - BRAKE LAMP SWITCH
- 4 - PIVOT SHAFT

(5) Pull the switch rearward and remove it from its mounting bracket.

(6) Remove the retaining clip from the brake pedal pin securing the power booster to the pedal using following procedure (Fig. 50). Position a small screwdriver between the center tang on the retaining clip

and the brake pedal pin. Rotate blade of screwdriver enough so center tang on retaining clip can pass over end of brake pedal pin, then pull retaining clip off brake pedal pin.

**Fig. 50 Brake Pedal Retaining Clip**

- 1 - BRAKE PEDAL
- 2 - INPUT ROD
- 3 - SCREWDRIVER
- 4 - RETAINING CLIP
- 5 - BRAKE PEDAL PIN

(7) Remove the booster input rod from the brake pedal pin.

(8) Remove the nut from the brake pedal pivot shaft (Fig. 49). The pivot shaft has a flat on it to hold while the nut is removed.

(9) Remove the brake pedal pivot shaft from the brake pedal and pedal mounting bracket.

(10) Remove the brake pedal with bushings from mounting bracket (Fig. 49).

**NOTE:** The bushings can be easily removed from the pedal by pulling them straight out each side.

**INSTALL**

(1) Make sure the pedal has a properly installed bushing on each side of the pedal (Fig. 49)

(2) Lubricate the brake pedal pivot shaft and brake pedal bushings using Mopar Lubriplate or an equivalent.

(3) Install the brake pedal in the pedal bracket (Fig. 49). Align the hole in brake pedal with the pivot shaft holes in the pedal bracket.

(4) Install the brake pedal shaft (Fig. 49).

(5) Install the nut on the end of the brake pedal pivot shaft. Tighten the nut to a torque of 34 N·m (25 ft. lbs.).

(6) Install the power brake booster input rod on the brake pedal pin.



## REMOVAL AND INSTALLATION (Continued)

**CAUTION:** When installing the retaining clip on the brake pedal pin a **NEW** retaining clip must be used to ensure the retention of the vacuum booster push rod.

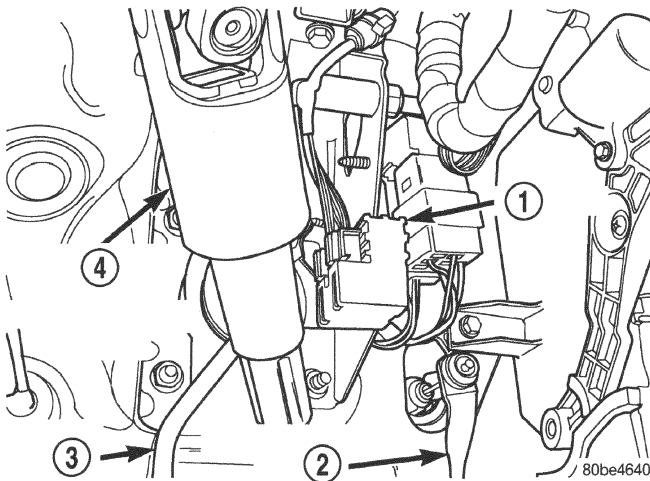
(7) Install a **new** retaining clip (Fig. 50) on the brake pedal pin.

(8) Using Mopar Lubriplate or an equivalent, lightly lubricate the surface of the brake pedal striker where the plunger of the brake lamp switch contacts it.

**NOTE:** Prior to installing the brake lamp switch into its bracket, the plunger must be moved to its fully extended position using the procedure in Step 9.

(9) Hold stop lamp switch firmly in one hand. Using other hand, pull outward on the plunger of the stop lamp switch until it has ratcheted out to its fully extended position.

(10) Install the brake lamp switch in the brake pedal bracket (Fig. 49). Install it using the following procedure. Depress the brake pedal as far down as possible. Then while holding brake pedal down, align the index key on switch with slot in square hole of mounting bracket. When switch is fully installed into the bracket, rotate stop lamp switch in a clockwise direction approximately 30 degrees until it is aligned straight up and down (Fig. 51).



**Fig. 51 Brake Lamp Switch**

- 1 - SWITCH
- 2 - ACCELERATOR PEDAL
- 3 - BRAKE PEDAL
- 4 - STEERING COLUMN INTERMEDIATE SHAFT

**CAUTION:** Do not use excessive force when pulling back on brake pedal to adjust the brake lamp switch. If too much force is used, damage to the brake lamp switch or striker can result.

(11) Gently release/pull back the brake pedal until it stops moving. This will cause the switch plunger to ratchet back to its correctly adjusted position.

(12) Install the heat distribution duct.

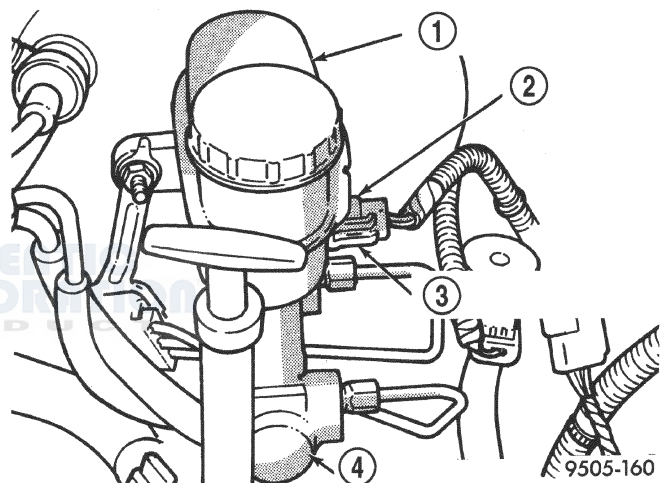
(13) Install the two screws securing the bottom of the knee bolster below the steering column in place (Fig. 48).

(14) Connect the remote ground cable for the battery on the ground post located on left shock tower (Fig. 46).

## MASTER CYLINDER

### REMOVE

(1) Remove wiring harness connector from brake fluid level sensor in master cylinder brake fluid reservoir (Fig. 52).



**Fig. 52 Master Cylinder Fluid Level Sensor**

- 1 - BRAKE FLUID RESERVOIR
- 2 - BRAKE FLUID LEVEL SENSOR
- 3 - WIRING HARNESS CONNECTOR
- 4 - MASTER CYLINDER

(2) Disconnect the primary and secondary brake tubes from the master cylinder outlet ports (Fig. 53) (Fig. 54). Install plugs at all open brake tube outlets on master cylinder assembly.

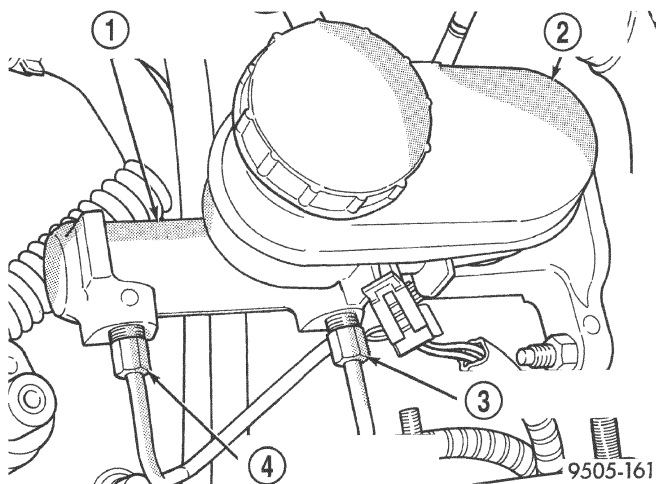
(3) Using Mopar, Brake Parts Cleaner or an equivalent, clean the area where the master cylinder attaches to the vacuum booster.

(4) Remove the 2 nuts (Fig. 55) attaching the master cylinder to the vacuum booster.

**CAUTION:** When removing the routing clip and brake tubes from the mounting stud, do not bend or kink the chassis brake line tubes.

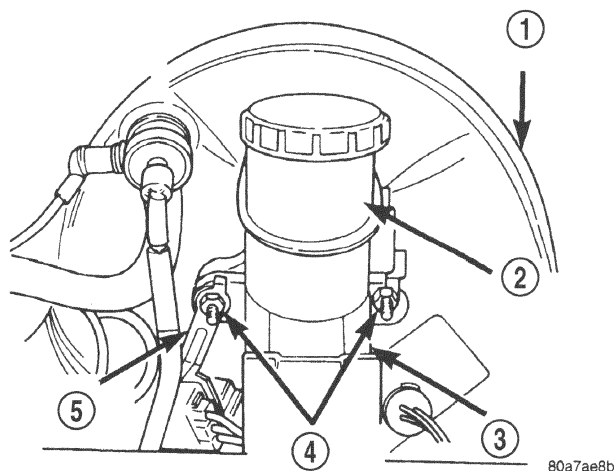
(5) Remove the routing clip and chassis brake tubes (Fig. 55)(as an assembly) from the mounting stud for the master cylinder.



**REMOVAL AND INSTALLATION (Continued)**

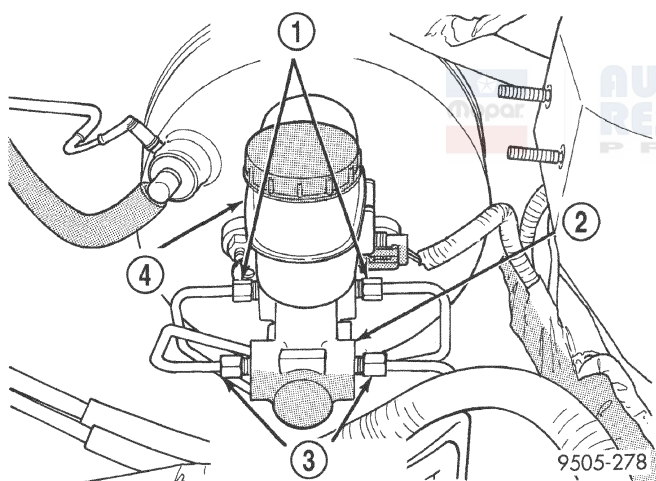
**Fig. 53 Master Cylinder Primary And Secondary Ports With ABS**

- 1 - MASTER CYLINDER ASSEMBLY
- 2 - BRAKE FLUID RESERVOIR
- 3 - MASTER CYLINDER PRIMARY PORT
- 4 - MASTER CYLINDER SECONDARY PORT



**Fig. 55 Master Cylinder Mounting To Vacuum Booster**

- 1 - BRAKE VACUUM BOOSTER
- 2 - BRAKE FLUID RESERVOIR
- 3 - MASTER CYLINDER
- 4 - MOUNTING NUTS
- 5 - ROUTING CLIP



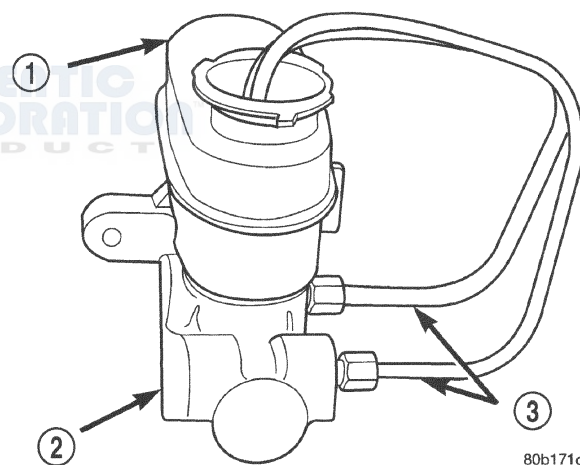
**Fig. 54 Master Cylinder Primary And Secondary Ports Without ABS**

- 1 - MASTER CYLINDER PRIMARY PORTS
- 2 - MASTER CYLINDER
- 3 - MASTER CYLINDER SECONDARY PORTS
- 4 - MASTER CYLINDER FLUID RESERVOIR

(6) Slide the master cylinder straight off its mounting studs on the vacuum booster.

**BLEEDING MASTER CYLINDER**

(1) Clamp the master cylinder in a vise. Attach Bleeding Tubes, Special Tool 6802 to the master cylinder outlet ports (Fig. 56) (Fig. 57). **Position the bleeding tubes so outlets of the tubes will be below the surface of the brake fluid when reservoir is filled to the proper level.**



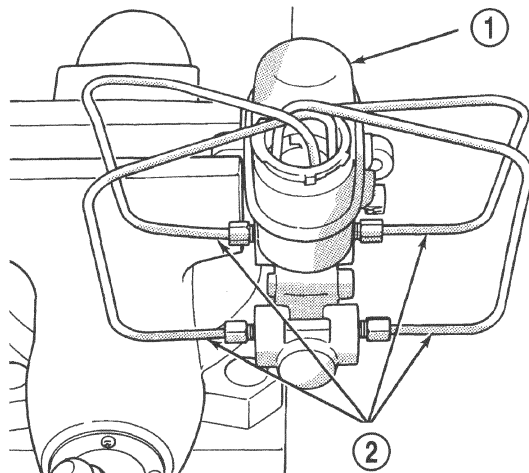
**Fig. 56 Bleeding Tubes Attached to ABS Master Cylinder**

- 1 - MASTER CYLINDER FLUID RESERVOIR
- 2 - MASTER CYLINDER
- 3 - SPECIAL TOOL 8129

(2) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(3) Insert an appropriate size wooden dowel in the end of the master cylinder piston (Fig. 58). Using the dowel, slowly depress the piston to the full extent of its travel and then allow the piston to return to its released position. Continue to repeat this step until bubbles no longer appear in the brake fluid. After no more air bubbles are expelled from the bleed tubes repeat the above procedure several more times to ensure all air is bled from master cylinder.

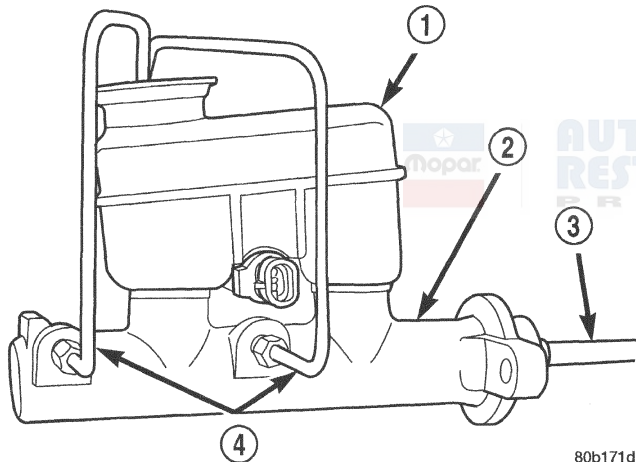
## REMOVAL AND INSTALLATION (Continued)



9505-279

**Fig. 57 Bleeding Tubes Attached to Non-ABS Master Cylinder**

- 1 - MASTER CYLINDER ASSEMBLY
- 2 - SPECIAL TOOL 6802



80b171d3

**Fig. 58 Bleeding Master Cylinder**

- 1 - BRAKE FLUID RESERVOIR
- 2 - MASTER CYLINDER
- 3 - WOODEN DOWEL
- 4 - SPECIAL TOOL 8129

(4) Remove the bleeding tubes from the outlet ports of the master cylinder.

(5) Plug outlet ports of master cylinder and install the cap on the reservoir.

(6) Remove the master cylinder from the vise.

**NOTE:** Note: It is not necessary to bleed the entire hydraulic system after replacing the master cylinder. However, the master cylinder must have been bled and filled upon installation.

## INSTALL

(1) Position master cylinder assembly on studs of power brake unit, aligning push rod on power brake vacuum booster with piston of master cylinder.

**CAUTION:** When installing the routing clip and brake tubes on the mounting stud, do not bend or kink the chassis brake line tubes. Be sure the chassis brake tubes are routed correctly. The chassis brake tubes can not touch each other or other components or the body of the vehicle.

(2) Install the routing clip and chassis brake tubes (Fig. 55) on the inboard mounting stud for the master cylinder.

(3) Install the 2 master cylinder to power brake vacuum booster mounting nuts (Fig. 55). Tighten both nuts to a torque of 28 N·m (250 in. lbs.).

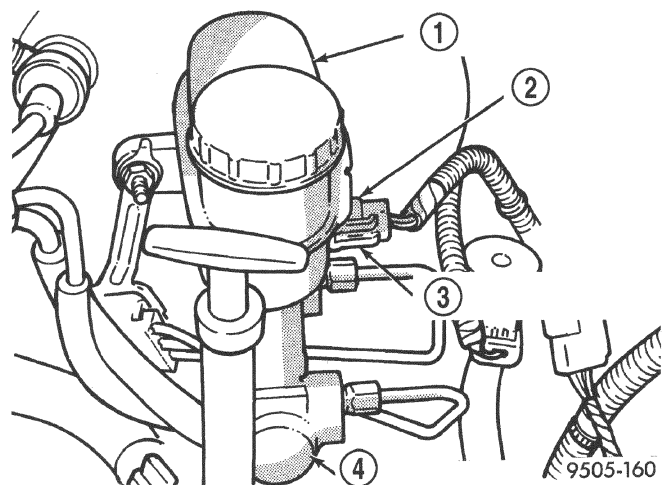
(4) Connect brake tubes to master cylinder primary and secondary ports (Fig. 53). Then tighten the tube nuts to a torque of 17 N·m (145 in. lbs.).

(5) Install the connector from the vehicle wiring harness on the fluid level sensor in the master cylinder fluid reservoir (Fig. 52)

## BRAKE FLUID LEVEL SWITCH

The master cylinder or brake fluid reservoir does not have to be removed from the vehicle for replacement of the brake fluid level sensor.

(1) Remove wiring harness connector from brake fluid reservoir level sensor (Fig. 59).



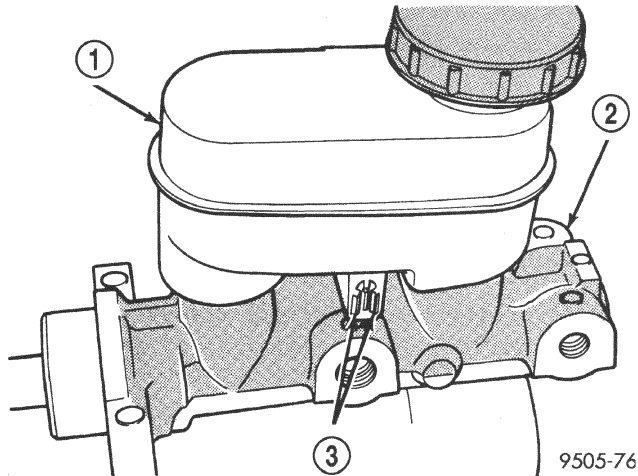
9505-160

**Fig. 59 Master Cylinder Fluid Level Sensor**

- 1 - BRAKE FLUID RESERVOIR
- 2 - BRAKE FLUID LEVEL SENSOR
- 3 - WIRING HARNESS CONNECTOR
- 4 - MASTER CYLINDER

**REMOVAL AND INSTALLATION (Continued)**

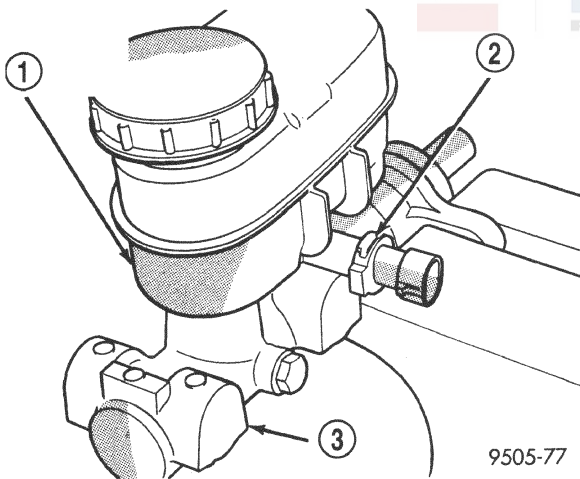
(2) Compress the retaining tabs (Fig. 60) on the end of the brake fluid level sensor.



**Fig. 60 Brake Fluid Level Switch Retaining Tabs**

- 1 - MASTER CYLINDER BRAKE FLUID RESERVOIR
- 2 - MASTER CYLINDER
- 3 - FLUID LEVEL SWITCH RETAINING TABS

(3) While compressing retaining tabs, grasp opposite end of brake fluid level sensor and pull it out of master cylinder fluid reservoir (Fig. 61).

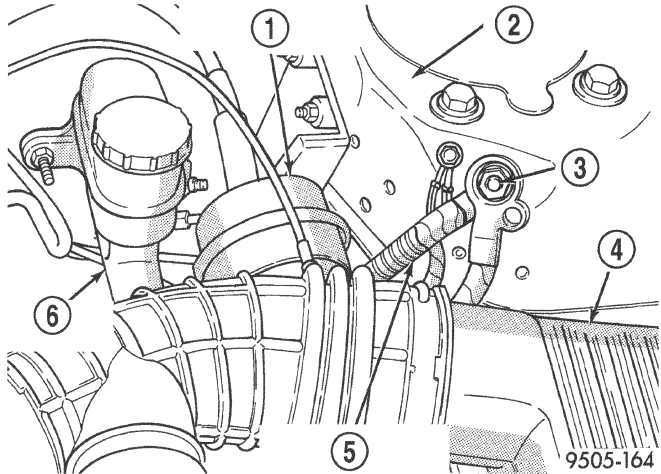


**Fig. 61 Removing Fluid Level Switch From Reservoir**

- 1 - MASTER CYLINDER BRAKE FLUID RESERVOIR
- 2 - BRAKE FLUID LEVEL SWITCH
- 3 - MASTER CYLINDER

**POWER BRAKE BOOSTER (2.5L ENGINE)****REMOVAL**

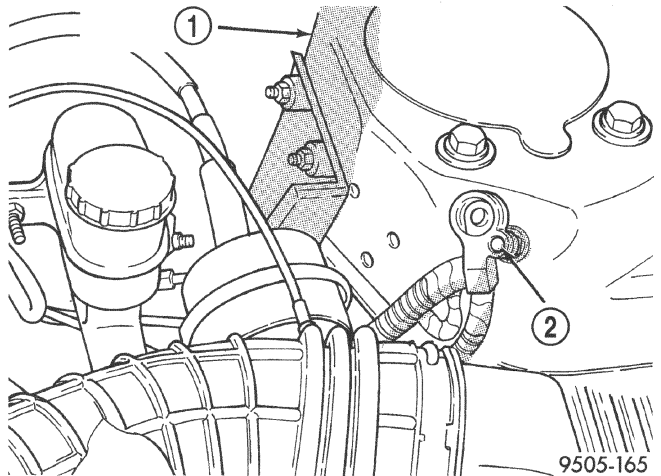
(1) Remove the remote ground cable from the ground stud located on the left shock tower (Fig. 62).



**Fig. 62 Ground Cable Attachment To Strut Tower**

- 1 - SPEED CONTROL SERVO
- 2 - LEFT STRUT TOWER
- 3 - GROUND STUD
- 4 - AIR CLEANER
- 5 - REMOTE GROUND CABLE
- 6 - MASTER CYLINDER

(2) Correctly isolate remote ground cable when servicing vehicle by installing the ground cable insulator on the strut tower ground stud as shown (Fig. 63). **This will prevent accidental grounding of the remote ground cable.**



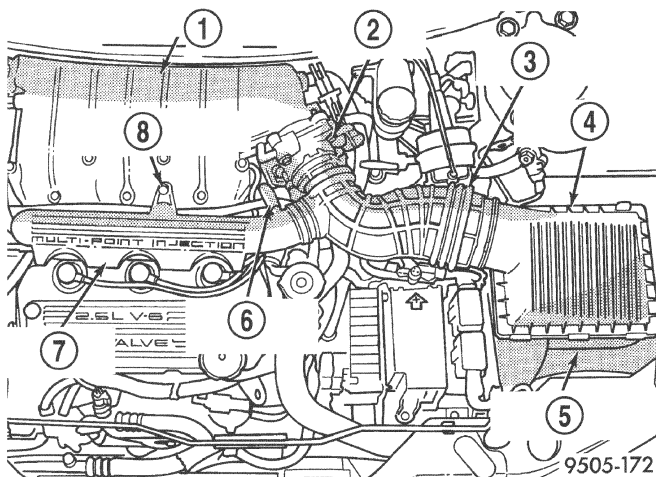
**Fig. 63 Correctly Isolated Remote Ground Cable**

- 1 - LEFT STRUT TOWER
- 2 - GROUND STUD



## REMOVAL AND INSTALLATION (Continued)

(3) Remove the PCV hose (Fig. 64) from the air chamber located on the front of the intake manifold. Remove bolt (Fig. 64) attaching the air chamber to the intake manifold. Then unlatch lid of air cleaner from air cleaner housing and loosen clamp attaching air inlet hose to throttle body (Fig. 64). Remove the air cleaner lid, air inlet hose and air chamber (Fig. 64) as an assembly from the engine.



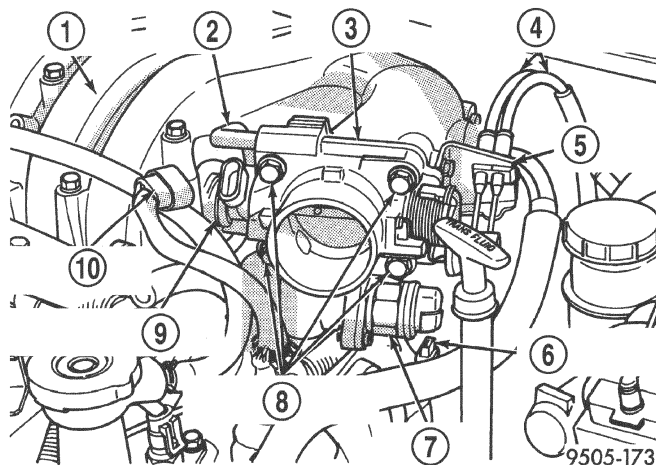
**Fig. 64 Engine Air Intake System Components**

- 1 - INTAKE MANIFOLD
- 2 - THROTTLE BODY
- 3 - AIR INLET HOSE
- 4 - AIR CLEANER LID
- 5 - AIR CLEANER HOUSING
- 6 - PCV HOSE
- 7 - AIR CHAMBER
- 8 - ATTACHING BOLT

(4) Remove the throttle cable and if equipped the speed control cable from the throttle body (Fig. 65). Remove the vacuum hose (Fig. 65) from the throttle body. Remove the wiring harness connectors from AIS motor and the Throttle Position Sensor (Fig. 65) on the throttle body. Then, remove the 4 bolts (Fig. 65) attaching the throttle body to the intake manifold and remove it from intake manifold.

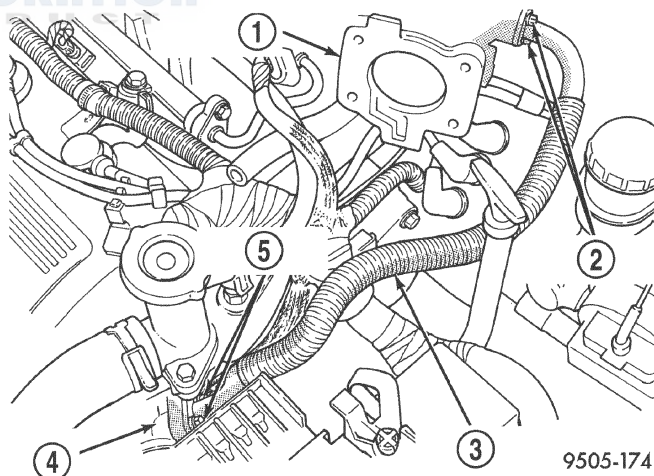
(5) Without removing cables from bracket, remove the throttle and speed control cable mounting bracket (Fig. 65) from the intake manifold.

(6) Remove the EGR tube (Fig. 66) from the intake manifold and EGR valve.



**Fig. 65 Throttle Body Attachment To Intake Manifold**

- 1 - INTAKE MANIFOLD
- 2 - VACUUM HOSE
- 3 - THROTTLE BODY
- 4 - SPEED CONTROL AND THROTTLE CABLE
- 5 - CABLE BRACKET
- 6 - ELECTRICAL CONNECTOR
- 7 - AIS MOTOR
- 8 - THROTTLE BODY MOUNTING BOLTS
- 9 - THROTTLE POSITION SENSOR
- 10 - ELECTRICAL CONNECTOR

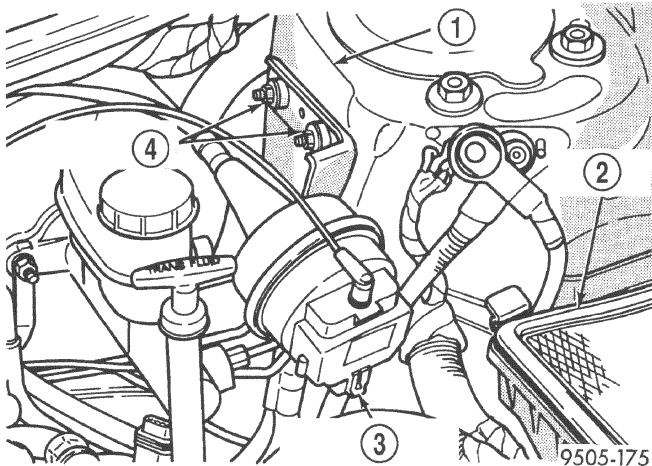


**Fig. 66 EGR Tube Attachment To Intake Manifold And EGR Valve**

- 1 - INTAKE MANIFOLD
- 2 - MOUNTING BOLTS
- 3 - EGR TUBE ASSEMBLY
- 4 - EGR VALVE
- 5 - MOUNTING BOLTS

**REMOVAL AND INSTALLATION (Continued)**

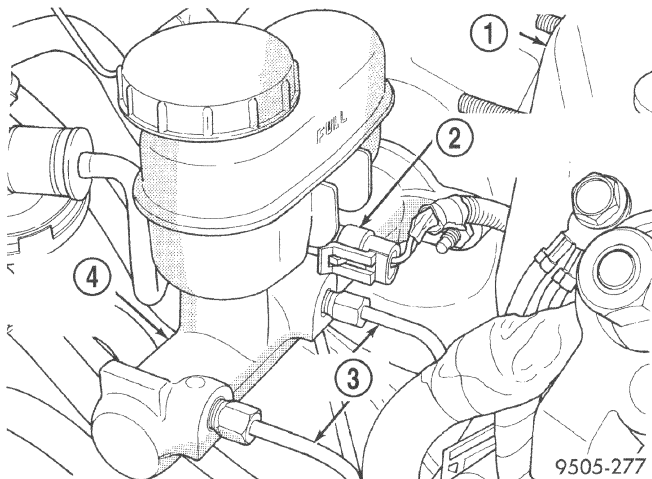
(7) If equipped, remove the vehicle's wiring harness connector from the speed control servo. Remove the 2 speed control servo mounting bracket to strut tower attaching nuts (Fig. 67). Without removing speed control cable from servo, move speed control servo out of the way.



**Fig. 67 Speed Control Servo Attachment To Strut Tower**

- 1 - STRUT TOWER
- 2 - AIR CLEANER
- 3 - SPEED CONTROL SERVO
- 4 - MOUNTING NUTS

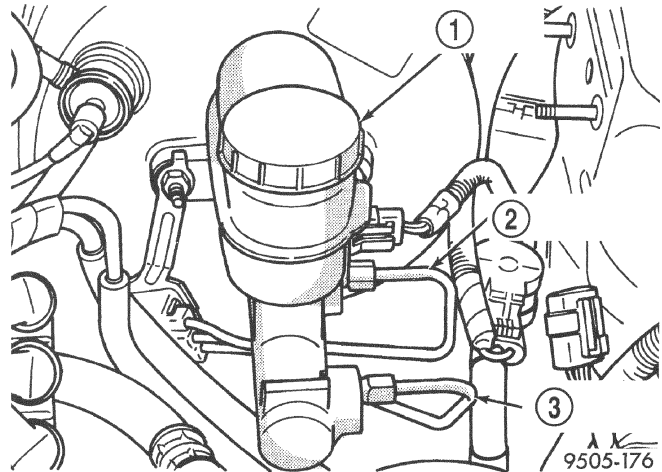
(8) Remove the wiring harness connector from the brake fluid level sensor in the master cylinder fluid reservoir (Fig. 68).



**Fig. 68 Master Cylinder Brake Fluid Level Sensor**

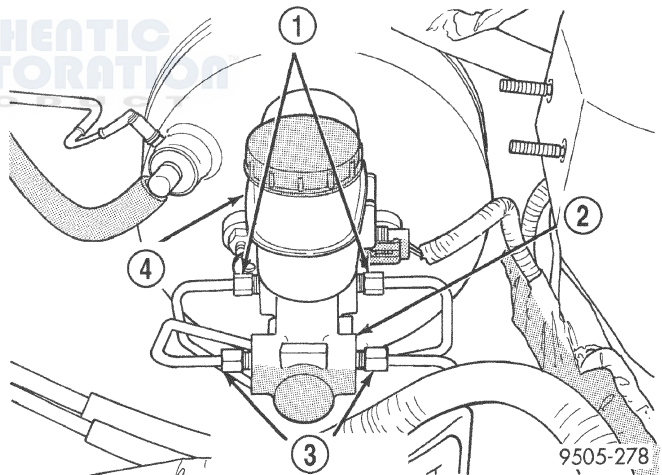
- 1 - LEFT SHOCK TOWER
- 2 - MASTER CYLINDER FLUID LEVEL SENSOR
- 3 - BRAKE TUBES
- 4 - MASTER CYLINDER ASSEMBLY

(9) Remove the primary and secondary brake tubes (Fig. 69) or (Fig. 70) from the master cylinder.



**Fig. 69 Primary And Secondary Brake Tubes With Antilock Brakes**

- 1 - MASTER CYLINDER ASSEMBLY
- 2 - PRIMARY BRAKE TUBE
- 3 - SECONDARY BRAKE TUBE



**Fig. 70 Primary And Secondary Brake Tubes Without Antilock Brakes**

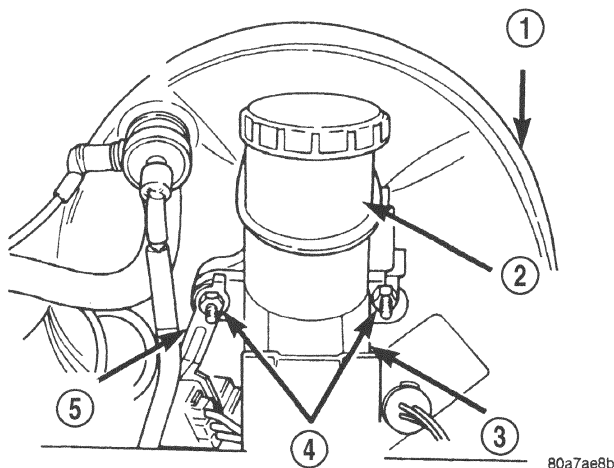
- 1 - MASTER CYLINDER PRIMARY PORTS
- 2 - MASTER CYLINDER
- 3 - MASTER CYLINDER SECONDARY PORTS
- 4 - MASTER CYLINDER FLUID RESERVOIR

(10) Remove the 2 nuts (Fig. 71) attaching the master cylinder assembly to the power brake vacuum booster.

**CAUTION:** When removing the routing clip and brake tubes from the mounting stud do not bend or kink the chassis brake line tubes.



## REMOVAL AND INSTALLATION (Continued)



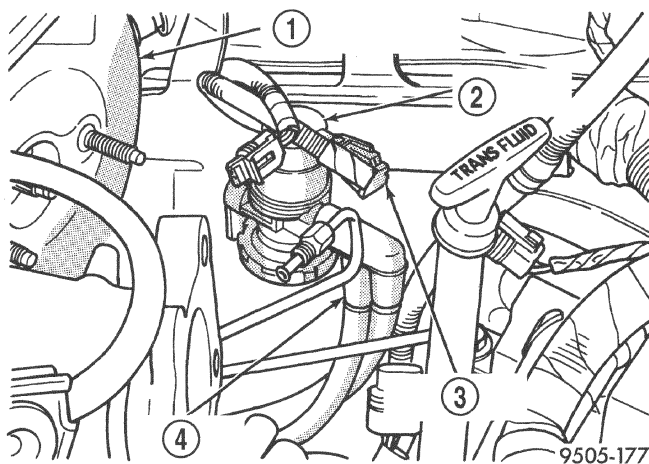
**Fig. 71 Master Cylinder Mounting To Vacuum Booster**

- 1 - BRAKE VACUUM BOOSTER
- 2 - BRAKE FLUID RESERVOIR
- 3 - MASTER CYLINDER
- 4 - MOUNTING NUTS
- 5 - ROUTING CLIP

(11) Remove the routing clip and chassis brake tubes (Fig. 71) (as an assembly) from the mounting stud for the master cylinder.

(12) Remove the master cylinder from the vacuum booster.

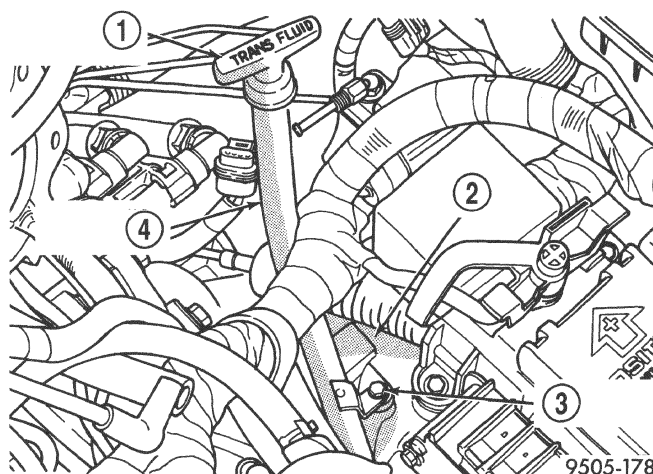
(13) Remove the vacuum harness connector and electrical connector from the purge solenoid (Fig. 72). Remove bracket and purge solenoid as an assembly from the vehicle.



**Fig. 72 Purge Control Solenoid**

- 1 - POWER BRAKE VACUUM BOOSTER
- 2 - PURGE SOLENOID
- 3 - ELECTRICAL CONNECTOR
- 4 - VACUUM HARNESS

(14) Remove dipstick tube attaching bolt (Fig. 73). Then remove the dipstick tube and dipstick (Fig. 73) as an assembly from the transaxle.

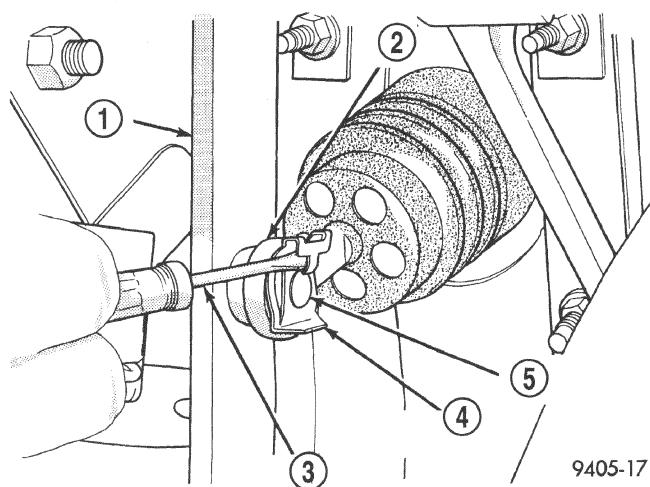


**Fig. 73 Transaxle Dipstick Tube**

- 1 - TRANSAXLE DIPSTICK
- 2 - TRANSAXLE
- 3 - ATTACHING BOLT
- 4 - DIPSTICK TUBE

(15) Remove the vacuum hoses from the check valve located on the power brake vacuum booster.

(16) Locate the power brake vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver between the center tang on the power brake booster input rod to brake pedal pin retaining clip (Fig. 74). Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. Replace only with a new retaining clip when assembled.**



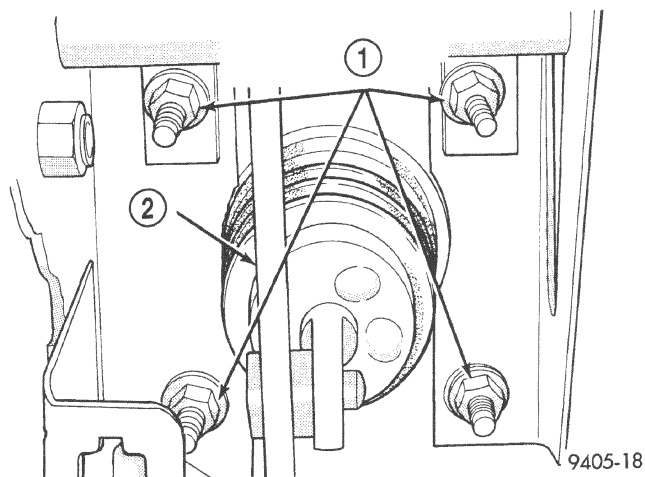
**Fig. 74 Input Rod Retaining Pin**

- 1 - BRAKE PEDAL
- 2 - INPUT ROD
- 3 - SCREWDRIVER
- 4 - RETAINING CLIP
- 5 - BRAKE PEDAL PIN



**REMOVAL AND INSTALLATION (Continued)**

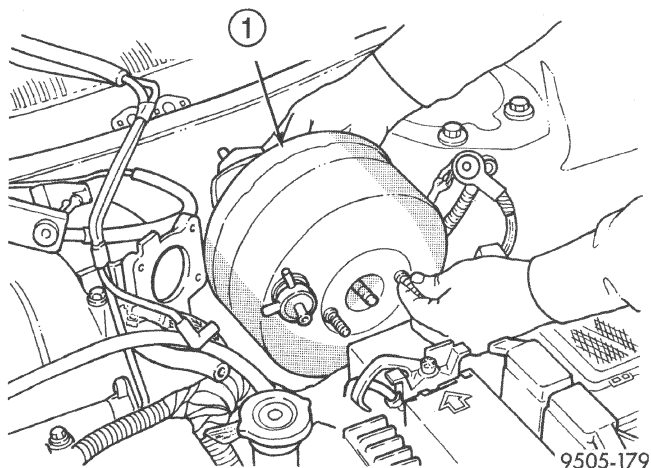
(17) Remove the 4 nuts attaching the vacuum booster to the dash panel. Nuts are accessible from under dash panel in area of the steering column and pedal bracket assembly (Fig. 75).



**Fig. 75 Vacuum Booster Mounting**

- 1 - POWER BRAKE BOOSTER MOUNTING NUTS  
2 - BRAKE PEDAL

(18) Slide the vacuum booster straight forward until mounting studs clear dash panel. Then lift the vacuum booster straight up to remove it from the vehicle (Fig. 76).



**Fig. 76 Power Brake Vacuum Booster Removal**

- 1 - POWER BRAKE VACUUM BOOSTER

**CAUTION:** Do not attempt to disassemble the power brake vacuum booster it is to be serviced **ONLY** as a complete assembly.

**INSTALLATION**

(1) Position power brake booster onto dash panel.

(2) Install and torque the 4 power brake vacuum booster mounting nuts (Fig. 75) to 37 N·m (27 ft. lbs.) torque.

(3) Using lubriplate, or an equivalent, coat the surfaces of the brake pedal pin that contact the power brake vacuum booster input rod.

(4) Connect power brake vacuum booster input rod to brake pedal pin and install a **NEW** retaining clip. **Use only a new retainer clip DO NOT USE the old clip.**

(5) Install the dipstick tube in transaxle (Fig. 73). Install dipstick tube attaching bolt and securely tighten (Fig. 73).

(6) Install the vacuum hoses on the check valve in the power brake vacuum booster.

(7) Position purge control solenoid (Fig. 72) on left front strut tower and install and securely tighten attaching bolt. Then correctly route and install the vacuum harness connector and electrical connector (Fig. 72) on the purge control solenoid.

(8) Position master cylinder on vacuum booster, aligning push rod on vacuum booster with the piston of the master cylinder.

**CAUTION:** When installing the routing clip and brake tubes on the mounting stud, do not bend or kink the chassis brake line tubes. Be sure the chassis brake tubes are routed correctly. The chassis brake tubes can not touch each other or other components or the body of the vehicle.

(9) Install the routing clip and chassis brake tubes on the inboard mounting stud for the master cylinder.

(10) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 71). Tighten the 2 mounting nuts to a torque of 28 N·m (250 in. lbs.).

(11) Install the primary and secondary brake tubes (Fig. 69) in the outlet ports of the master cylinder. Tighten the tube nuts to a torque of 17 N·m (145 in. lbs.).

(12) Install the vehicle's wiring harness connector on the master cylinder brake fluid level sensor (Fig. 68).

(13) If equipped, install speed control servo on the mounting studs in the left strut tower (Fig. 67). Install the 2 speed control servo bracket mounting nuts (Fig. 67). Tighten the 2 mounting nuts to a torque of 6 N·m (55 in. lbs.). Install electrical connector on speed control servo.

(14) Install the EGR tube with **NEW** gaskets on the intake manifold and EGR valve (Fig. 66). Install the 4 mounting bolts and tighten to a torque of 11 N·m (95 in. lbs.).

(15) Install the throttle body and a **NEW** gasket on the intake manifold. Install the 4 throttle body

## REMOVAL AND INSTALLATION (Continued)

attaching bolts (Fig. 65) and tighten to a torque of 22 N·m (200 in. lbs.).

(16) Install the vacuum hose (Fig. 65) on the throttle body. Install the wiring harness connectors on the AIS motor and the Throttle Position Sensor (Fig. 65) located on the throttle body.

(17) Install the mounting bracket for the throttle cable and speed control cable onto the intake manifold and securely tighten the mounting bolts.

(18) Install the throttle cable, and if equipped, the speed control cable on the cam of the throttle body assembly.

(19) Install the air cleaner lid, air inlet hose and air chamber (Fig. 64) as an assembly on the engine. Latch lid of air cleaner to air cleaner housing. Securely tighten the clamp attaching the air inlet hose to the throttle body (Fig. 64). Install and securely tighten the bolt attaching the air chamber to the intake manifold (Fig. 64).

(20) Install the remote ground cable (Fig. 62) on the ground stud located on the left strut tower (Fig. 62). Install and securely tighten the ground cable attaching nut.

(21) Check brake light switch for correct adjustment. If required, adjust stop lamp switch as necessary. See required procedure in the Service Adjustments Section in this group of the service manual.

(22) Road test vehicle to ensure proper operation of the vehicles brake system.

## BRAKE TUBES AND HOSES

Always use Mopar replacement brake hose assemblies to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that the tube and hose mating surfaces are clean and free from nicks and burrs. **Hose assemblies for each brake are unique and not interchangeable.**

Use new copper seal washers on all connections using Banjo Bolts and tighten all fittings to their specified torques.

The flexible front hydraulic brake hose should always be installed on the vehicle by first attaching the Banjo connector to the disc brake caliper. After routing the flex hose around the strut, hand start the chassis brake tube nut into the end of the flex hose. Following this procedure will prevent twisting of the flex hose when the flex hose bracket is attached to the front frame rail. Then tighten all brake line fitting to the specified torques.

On vehicles equipped with rear drum brakes, loosely connect the flex hose tube nut to the wheel cylinder, and then secure the flex hose bracket to the brake support plate. After the flex hose bracket is secured to the brake support plate, tighten the flex hose to wheel cylinder tube nut to the specified

torque. Then hand start the chassis tube nut to the opposite end of the flex hose. After chassis tube nut is hand started into flex hose attach the flex hose bracket to the rear frame rail. Then tighten the nut on the chassis brake tube to the specified torque. Following this procedure will reduce the potential for twisting the flex hose during the installation procedure.

Only double wall 4.75 mm (3/16 in.) steel brake line tubing, with Al-Rich/ZN-AL alloy coating should be used for replacement. Care must be taken when replacing brake tubing, to be sure the proper bending and flaring tools and procedures are used to avoid kinking. Do not route the tubes against sharp edges, moving components or into hot areas. All tubes should be properly attached with recommended retaining clips.

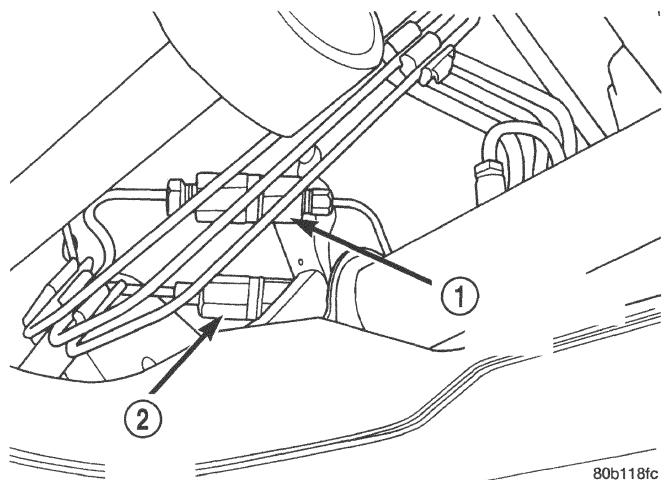
## PROPORTIONING VALVE

**NOTE:** The following procedure is for removal and installation of the proportioning valve(s) on vehicles without antilock brakes. For the procedure to remove and install the proportioning valve(s) on vehicles with antilock brakes refer to **ANTILOCK BRAKE SYSTEM** in this group.

### REMOVAL

(1) Remove hydraulic brake line (Fig. 77) from proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

(2) Then remove the proportioning valve from the rear brake line.



**Fig. 77 Non-ABS Brake Proportioning Valve Location**

- 1 - LEFT REAR PROPORTIONING VALVE
- 2 - RIGHT REAR PROPORTIONING VALVE



**REMOVAL AND INSTALLATION (Continued)****INSTALLATION**

(1) Install proportioning valve in rear brake line and hand tighten both tube nuts until they are fully seated in proportioning valve (Fig. 77).

(2) Tighten both brake line tube nuts at the proportioning valve to a torque of 17 N·m (145 in. lbs.).

(3) Bleed the affected brake line. Refer to **BASE BRAKE BLEEDING** in **SERVICE PROCEDURES** in this section.

**DISC BRAKE CALIPER (FRONT)**

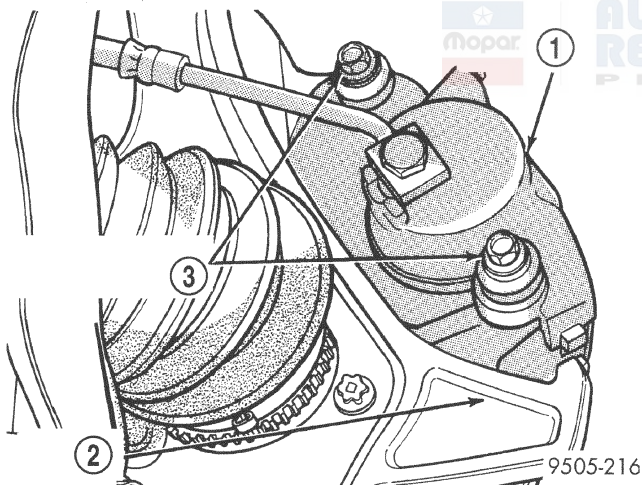
**NOTE:** Before proceeding, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

**REMOVAL**

(1) Raise vehicle on jackstands or centered on a hoist. See **Hoisting** in the **Lubrication and Maintenance** section of this manual.

(2) Remove front wheel and tire assemblies from vehicle.

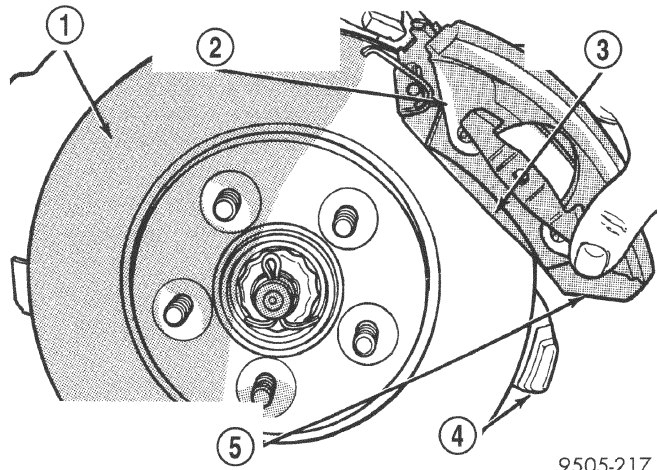
(3) Remove the 2 caliper to steering knuckle guide pin bolts (Fig. 78).

**Fig. 78 Removing Caliper Guide Pin Bolts**

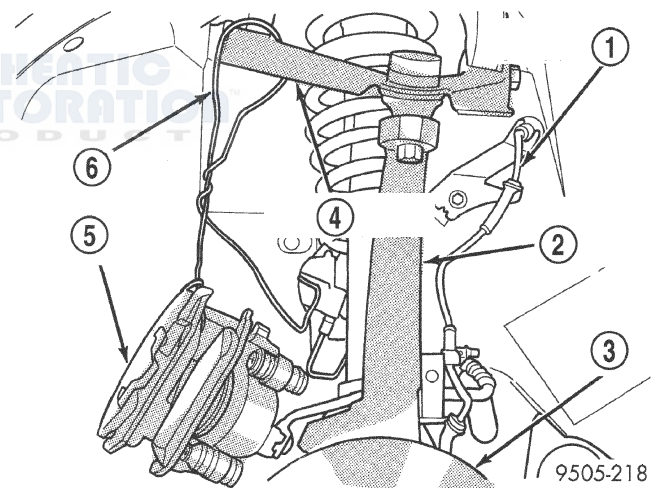
- 1 - DISC BRAKE CALIPER ASSEMBLY
- 2 - STEERING KNUCKLE
- 3 - CALIPER ASSEMBLY GUIDE PIN BOLTS

(4) Remove brake caliper from steering knuckle, by first rotating bottom end of caliper away from steering knuckle. Then slide top of caliper down from the machined abutment on steering knuckle (Fig. 79).

(5) **Support caliper from upper control arm to prevent weight of caliper from being supported by brake flex hose. Supporting disc brake caliper from flex hose can damage the hose (Fig. 80).**

**Fig. 79 Removing / Installing Brake Caliper**

- 1 - ROTOR
- 2 - DISC BRAKE CALIPER ASSEMBLY
- 3 - OUTBOARD BRAKE SHOE
- 4 - STEERING KNUCKLE
- 5 - LIFT THIS END OF CALIPER AWAY FROM STEERING KNUCKLE FIRST

**Fig. 80 Storing Caliper**

- 1 - ABS SPEED SENSOR CABLE
- 2 - STEERING KNUCKLE
- 3 - ROTOR
- 4 - UPPER CONTROL ARM
- 5 - DISC BRAKE CALIPER ASSEMBLY
- 6 - WIRE HANGER

**INSTALLATION**

(1) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(2) If removed, install the front rotor on the hub, making sure it is squarely seated on face of hub.



## REMOVAL AND INSTALLATION (Continued)

**CAUTION:** Use care when installing the caliper assembly onto the steering knuckle so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

(3) Carefully position caliper and brake shoe assemblies over brake rotor by first hooking top of brake shoes on the machined abutment on upper steering knuckle (Fig. 79). Then rotate the bottom of the brake caliper into position on the steering knuckle. **Make sure that caliper guide pin bolts, bushings and sleeves are clear of the steering knuckle bosses.**

**NOTE:** When being installed, extreme caution must be taken not to cross thread the caliper guide pin bolts.

(4) Install the brake caliper guide pin bolts (Fig. 78). Then tighten the guide pin bolts to a torque of 22 N·m (16 ft. lbs.).

(5) Install the wheel and tire assembly.

(6) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(7) Remove jackstands or lower hoist.

(8) Check and adjust brake fluid level as necessary.

**NOTE:** Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

(9) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoes.

## DISC BRAKE SHOES (FRONT)

**NOTE:** Before proceeding, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

### REMOVAL

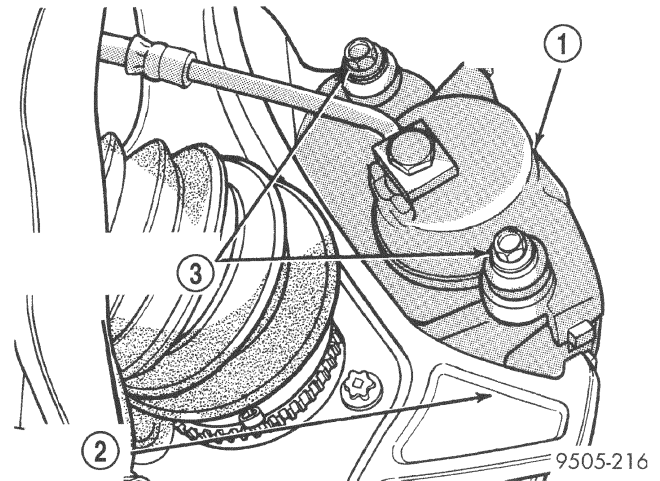
(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove front wheel and tire assemblies from vehicle.

**CAUTION:** When prying the piston back into the bore of the caliper do not use a hard pry bar. The use of a hard pry bar will damage the braking surface of the rotor.

(3) Slightly pry the piston back into the bore of the disc brake caliper. The piston is to be pryed back by inserting a soft tool (such as a trim stick) between the inboard brake shoe and the rotor and prying against the inboard brake shoe. This will force the piston back into the caliper.

(4) Remove the 2 brake caliper to steering knuckle guide pin bolts (Fig. 81).



**Fig. 81 Removing Caliper Guide Pin Bolts**

- 1 - DISC BRAKE CALIPER ASSEMBLY
- 2 - STEERING KNUCKLE
- 3 - CALIPER ASSEMBLY GUIDE PIN BOLTS

(5) Remove brake caliper from steering knuckle, by first rotating bottom of brake caliper away from the steering knuckle. Then slide top of brake shoes down and out from the top machined abutment on steering knuckle (Fig. 82).

(6) **Support brake caliper from upper control arm to prevent weight of caliper from being supported by brake flex hose. Supporting disc brake caliper from flex hose can damage the hose (Fig. 83).**

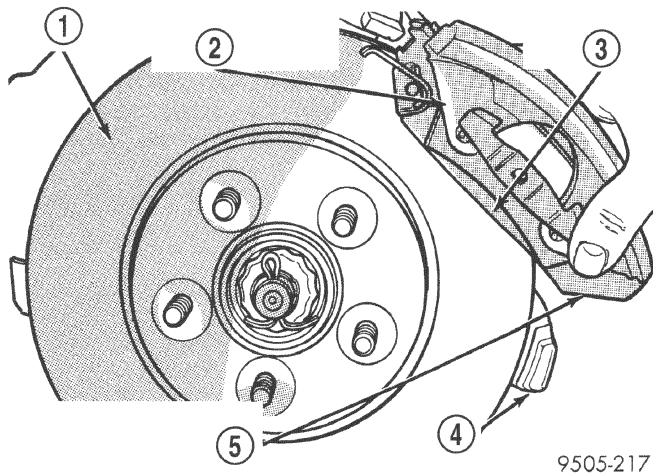
(7) Remove the brake rotor from the front hub (Fig. 84).

(8) Remove outboard brake shoe by pushing the brake shoe inward until retaining pins on brake shoe can be removed from holes in caliper (Fig. 85). Then slide the brake shoe off the caliper.

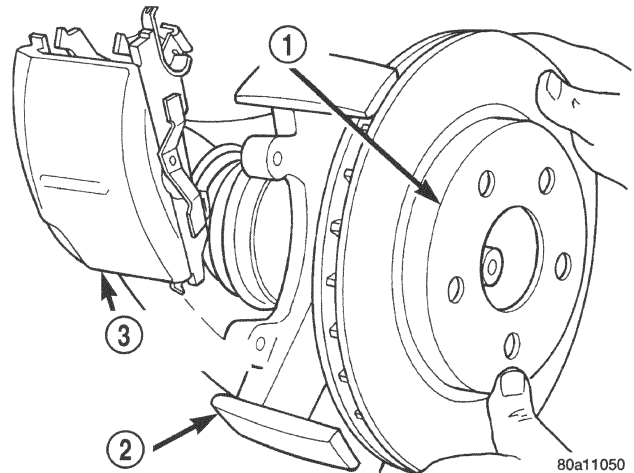
(9) Pull inboard brake shoe away from piston until retaining clip is free from cavity in piston (Fig. 86).

### CALIPER INSPECTION

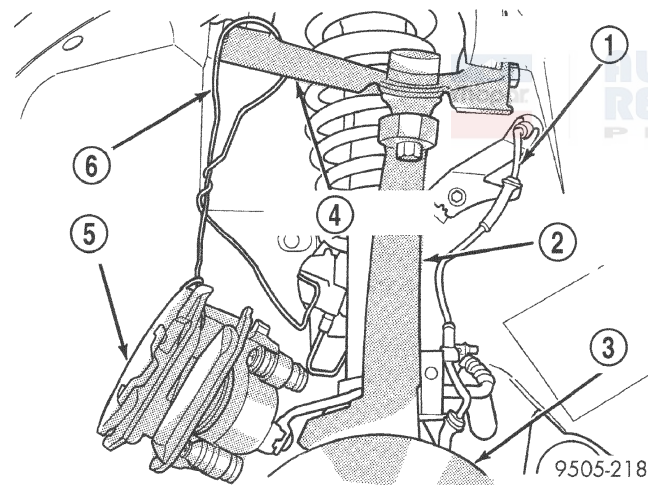
Check caliper for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of the piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper and install a new seal and boot, (and piston if scored). Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.

**REMOVAL AND INSTALLATION (Continued)****Fig. 82 Removing Brake Caliper**

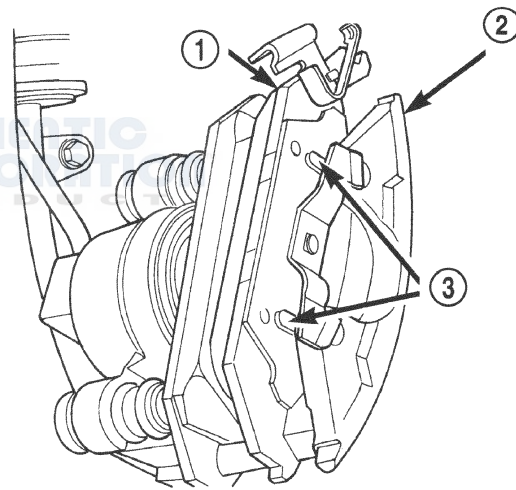
- 1 - ROTOR
- 2 - DISC BRAKE CALIPER ASSEMBLY
- 3 - OUTBOARD BRAKE SHOE
- 4 - STEERING KNUCKLE
- 5 - LIFT THIS END OF CALIPER AWAY FROM STEERING KNUCKLE FIRST

**Fig. 84 Removing / Installing Brake Rotor**

- 1 - BRAKING DISC
- 2 - STEERING KNUCKLE
- 3 - DISC BRAKE CALIPER ASSEMBLY (STORED)

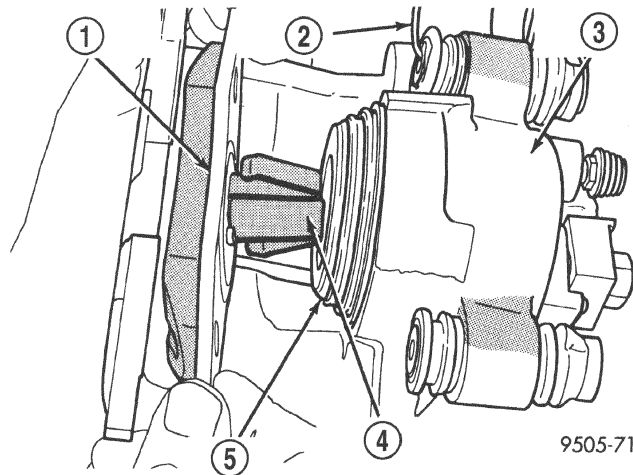
**Fig. 83 Storing Caliper**

- 1 - ABS SPEED SENSOR CABLE
- 2 - STEERING KNUCKLE
- 3 - ROTOR
- 4 - UPPER CONTROL ARM
- 5 - DISC BRAKE CALIPER ASSEMBLY
- 6 - WIRE HANGER

**Fig. 85 Removing / Installing Outboard Brake Shoe**

- 1 - OUTBOARD BRAKE SHOE
- 2 - BRAKE CALIPER
- 3 - BRAKE SHOE RETAINING PINS



**REMOVAL AND INSTALLATION (Continued)****Fig. 86 Removing Inboard Brake Shoe**

- 1 - INBOARD BRAKE SHOE
- 2 - HANGER WIRE
- 3 - CALIPER ASSEMBLY
- 4 - RETAINING CLIP
- 5 - PISTON

Check the caliper dust boot and caliper pin bushings to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

**INSTALLATION**

(1) Completely retract caliper piston back into piston bore of caliper assembly. This is required for caliper installation with new brake shoe assemblies.

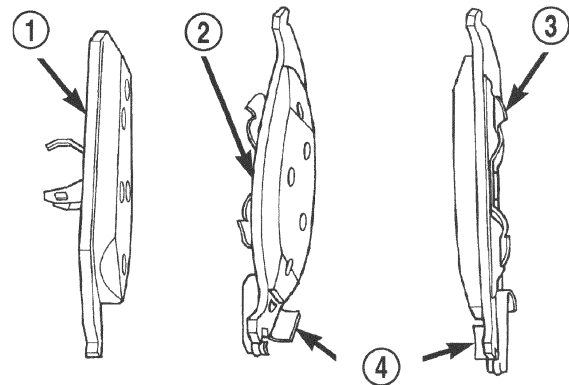
(2) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) Install the front rotor on the hub, making sure it is squarely seated on face of hub (Fig. 84).

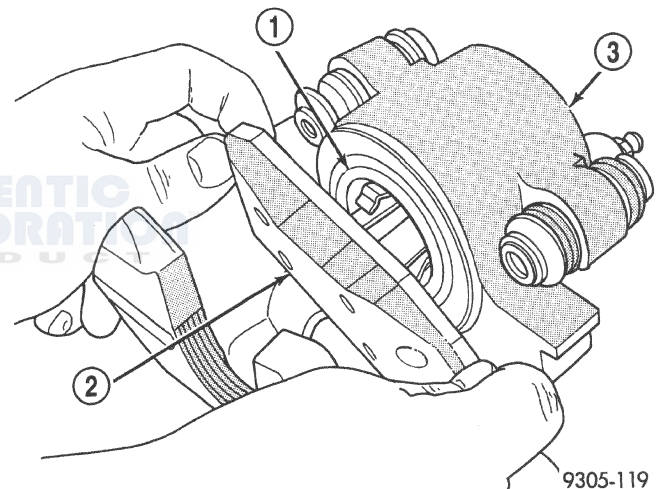
(4) Remove the protective paper from the noise suppression gasket on both the inner and outer brake shoe assemblies (if equipped).

**NOTE:** Note: The inboard and outboard brake shoes are not common (Fig. 87). Be sure the correct outer brake shoe is installed in the correct caliper. The left and right outer brake shoes are different and must be installed correctly. The wear sensor (Fig. 87) and the hold down clip must be on the upper end of the caliper when the caliper and brake shoes are installed on the steering knuckle.

(5) Install the new inboard brake shoe assembly into the caliper piston by firmly pressing into piston bore (Fig. 88). Be sure inboard brake shoe assembly is positioned squarely against face of caliper piston.

**Fig. 87 Front Brake Shoe Assembly Identification**

- 1 - INBOARD BRAKE SHOE
- 2 - LEFT OUTBOARD BRAKE SHOE
- 3 - RIGHT OUTBOARD BRAKE SHOE
- 4 - WEAR INDICATOR

**Fig. 88 Installing Inboard Brake Shoe Assembly**

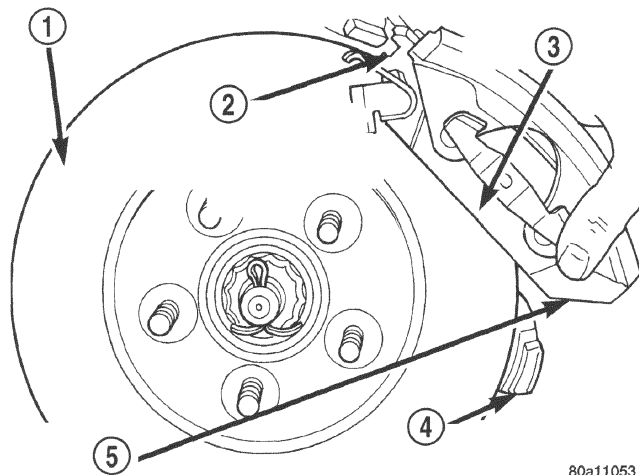
- 1 - PISTON
- 2 - BRAKE SHOE
- 3 - CALIPER ASSEMBLY

(6) Slide the new outboard brake shoe assembly onto the caliper assembly (Fig. 85).

**CAUTION:** Use care when installing the caliper assembly onto the steering knuckle so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses. Also, make sure that caliper guide pin bushings and sleeves are clear of the steering knuckle bosses.

(7) Carefully position brake caliper and brake shoes over brake rotor by first hooking top of brake shoes onto upper abutment on steering knuckle (Fig. 89). Then rotate caliper into position at bottom of steering knuckle.



**REMOVAL AND INSTALLATION (Continued)****Fig. 89 Installing Brake Caliper**

- 1 - ROTOR
- 2 - INSTALL THIS END OF CALIPER UNDER STEERING KNUCKLE FIRST
- 3 - OUTBOARD BRAKE SHOE
- 4 - STEERING KNUCKLE
- 5 - DISC BRAKE CALIPER

**NOTE:** When installing guide pin bolts, extreme caution should be taken not to cross thread the caliper guide pin bolts.

(8) Install the caliper guide pin bolts (Fig. 81) and tighten to a torque of 22 N·m (16 ft. lbs.).

(9) Install the wheel and tire assembly.

(10) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(11) Remove jackstands or lower hoist.

(12) Check brake fluid level.

**NOTE:** Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

(13) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoes.

**DISC BRAKE CALIPER (REAR)**

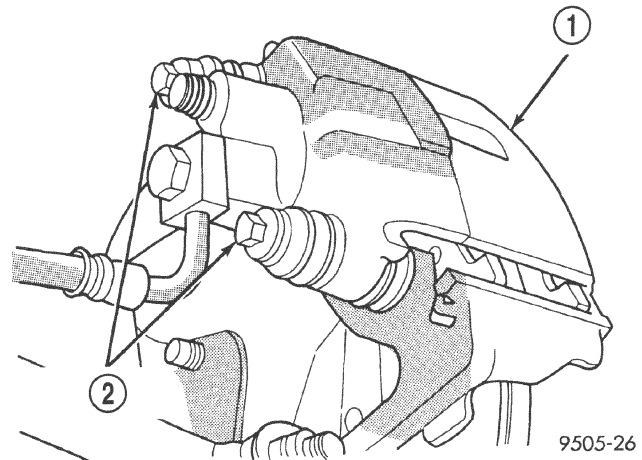
**NOTE:** Before proceeding, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

**REMOVAL**

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

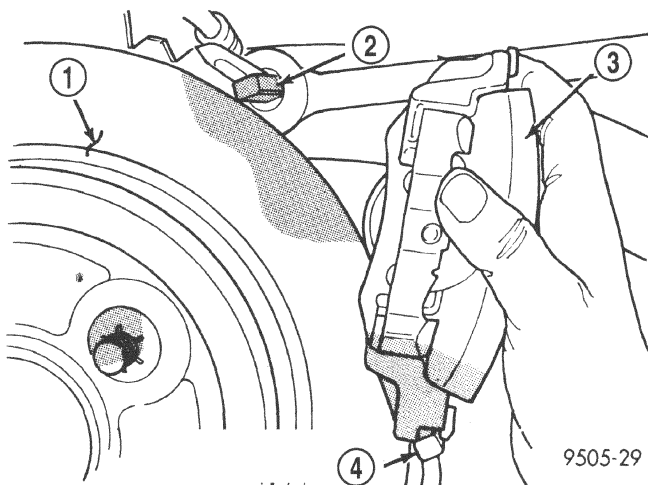
(2) Remove rear wheels and tires from vehicle.

(3) Remove the 2 guide pin bolts mounting the caliper to the adapter (Fig. 90).

**Fig. 90 Caliper Guide Pin Bolts**

- 1 - DISC BRAKE CALIPER
- 2 - CALIPER GUIDE PIN BOLTS

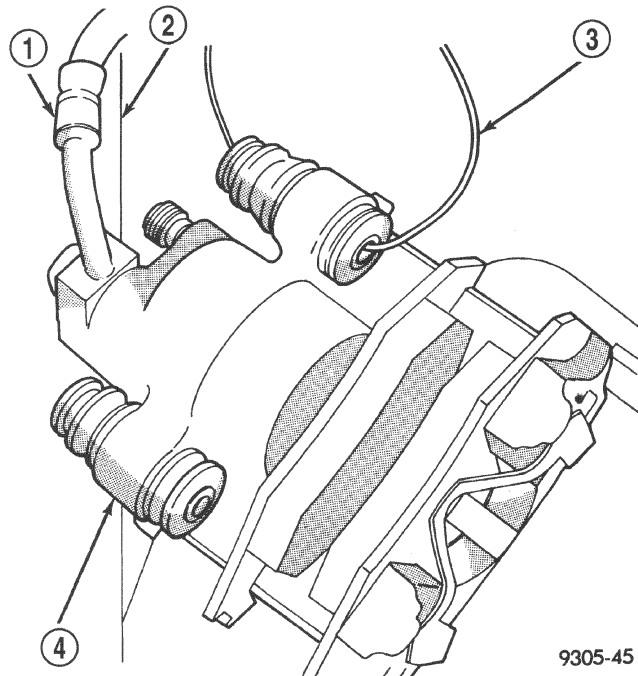
(4) Remove caliper from adapter and rotor by first rotating top of caliper away from the adapter, and then lifting the caliper off lower machined abutment on adapter (Fig. 91).

**Fig. 91 Removing Caliper From Adapter**

- 1 - BRAKING DISC
- 2 - CALIPER ADAPTER
- 3 - CALIPER
- 4 - LOWER MACHINED ADAPTER ABUTMENT

## REMOVAL AND INSTALLATION (Continued)

(5) Support the caliper from the rear strut to prevent weight of caliper from damaging the flexible brake hose (Fig. 92).



**Fig. 92 Storing Caliper**

- 1 - FLEX HOSE
- 2 - STRUT
- 3 - WIRE HANGER
- 4 - CALIPER ASSEMBLY

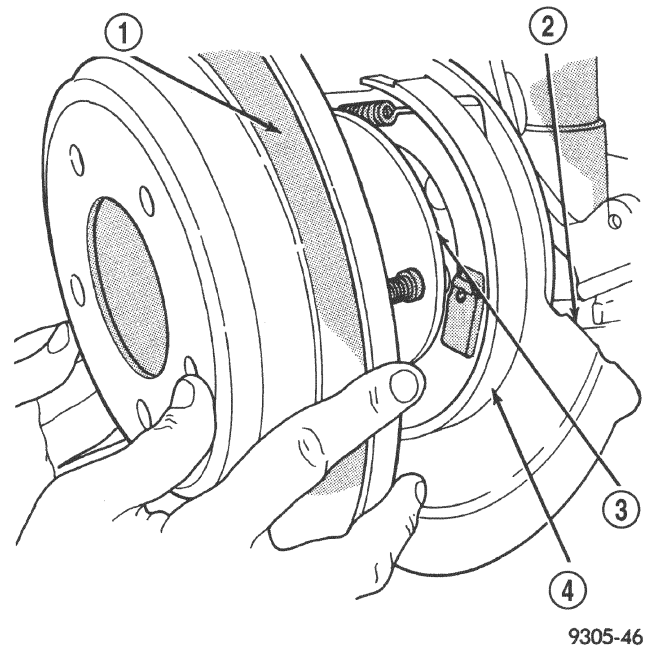
## INSTALLATION

**NOTE:** Step 1 below is only required when installing the disc brake caliper, after new brake shoes have been installed.

- (1) Completely retract caliper piston back into piston bore of caliper assembly.
- (2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.
- (3) If removed, install the rotor on the hub making sure it is squarely seated on the face of the hub (Fig. 93).

**CAUTION:** Use care when installing caliper assembly onto adapter so the guide pin bushings and sleeves do not get damaged by the mounting bosses on adapter.

- (4) Carefully lower caliper and brake shoes over rotor reversing the removal procedure (Fig. 91). Make sure that the caliper guide pin bolts, bushings and sleeves are clear of the adapter bosses.



**Fig. 93 Installing Rear Rotor**

- 1 - BRAKING DISC
- 2 - DISC SHIELD
- 3 - HUB
- 4 - DRUM-IN-HAT PARKING BRAKE

**CAUTION:** Extreme caution should be taken not to cross thread the caliper guide pin bolts when they are installed.

- (5) Install the caliper guide pin bolts (Fig. 90). Tighten the caliper guide pin bolts to a torque of 22 N·m (192 in. lbs.).
- (6) Install wheels and tires.
- (7) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).
- (8) Remove jackstands or lower hoist.
- (9) Check brake fluid level.

**NOTE:** Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

- (10) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

## DISC BRAKE SHOES (REAR)

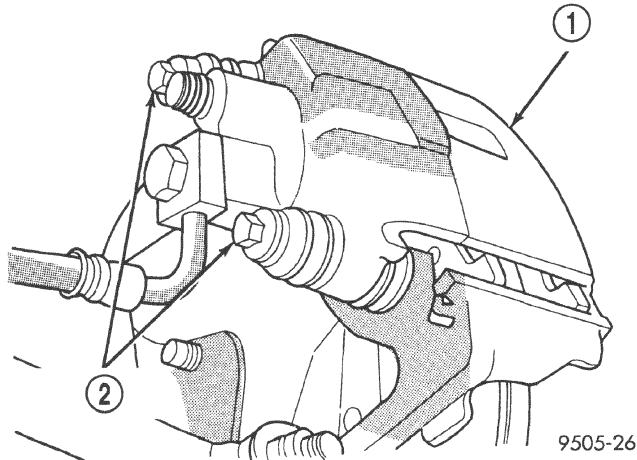
**NOTE:** Before proceeding, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

**REMOVAL AND INSTALLATION (Continued)****REMOVAL**

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

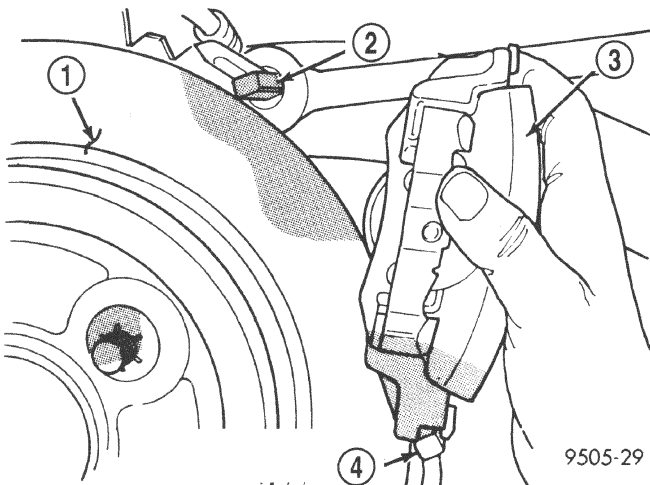
(2) Remove rear wheels and tires from vehicle.

(3) Remove the 2 guide pin bolts mounting the caliper to the adapter (Fig. 94).

**Fig. 94 Caliper Guide Pin Bolts**

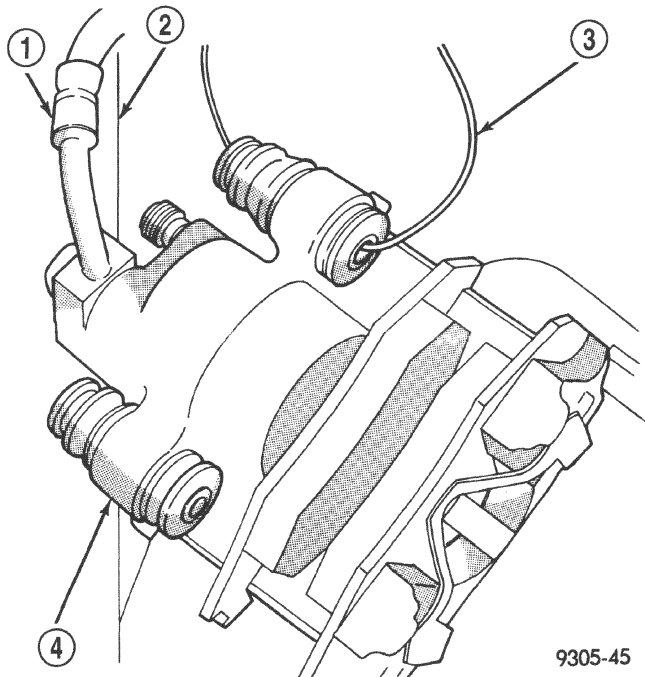
- 1 - DISC BRAKE CALIPER
- 2 - CALIPER GUIDE PIN BOLTS

(4) Remove caliper from adapter and rotor by first rotating the top of the caliper away from adapter, and then lifting the caliper off the lower machined abutment on adapter (Fig. 95).

**Fig. 95 Caliper Removal/Installation**

- 1 - BRAKING DISC
- 2 - CALIPER ADAPTER
- 3 - CALIPER
- 4 - LOWER MACHINED ADAPTER ABUTMENT

(5) Support caliper from rear strut to prevent weight of caliper from damaging the flexible brake hose (Fig. 96).

**Fig. 96 Storing Caliper**

- 1 - FLEX HOSE
- 2 - STRUT
- 3 - WIRE HANGER
- 4 - CALIPER ASSEMBLY

(6) Remove rear rotor from hub/bearing (Fig. 97). Then inspect drum-in-hat parking brake shoes and parking brake braking surface on rotor for any signs of excessive wear or damage. Replace parking brake shoes if required.

(7) Remove outboard brake pad from caliper by prying brake pad retaining clip over raised area on caliper. Then slide brake pad down and off the caliper (Fig. 98).

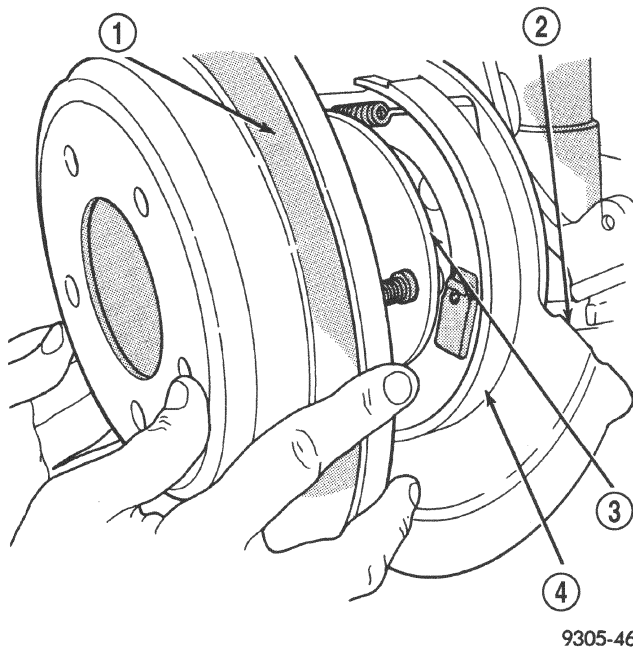
(8) Pull inboard brake pad away from caliper piston, until retaining clip is free from cavity in piston. (Fig. 99).

**CALIPER INSPECTION**

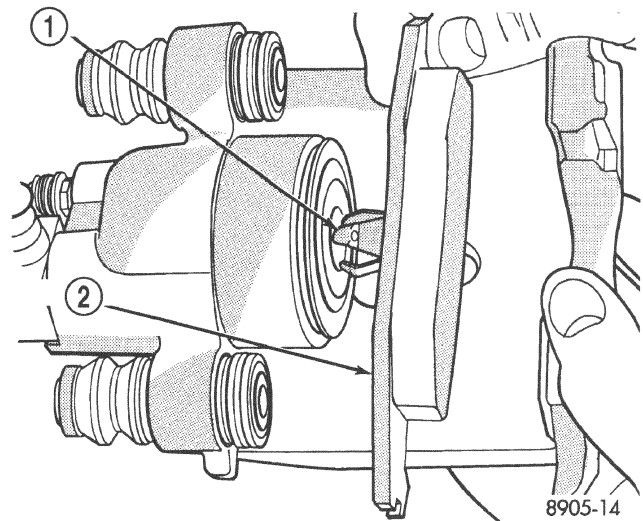
Check caliper for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of the piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper and install a new seal and boot, (and piston if scored). Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.



## REMOVAL AND INSTALLATION (Continued)

**Fig. 97 Rear Brake Rotor**

- 1 - BRAKING DISC
- 2 - DISC SHIELD
- 3 - HUB
- 4 - DRUM-IN-HAT PARKING BRAKE

**Fig. 99 Removing Inboard Brake Pad**

- 1 - RETAINING CLIP
- 2 - INBOARD SHOE

Check the caliper dust boot and caliper pin bushings to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle.

**INSTALLATION**

(1) Completely retract the caliper piston back into the piston bore of the caliper. This is required for caliper installation when new brake pad assemblies are installed on caliper.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) Install rear rotor on hub making sure it is squarely seated on face of hub (Fig. 97).

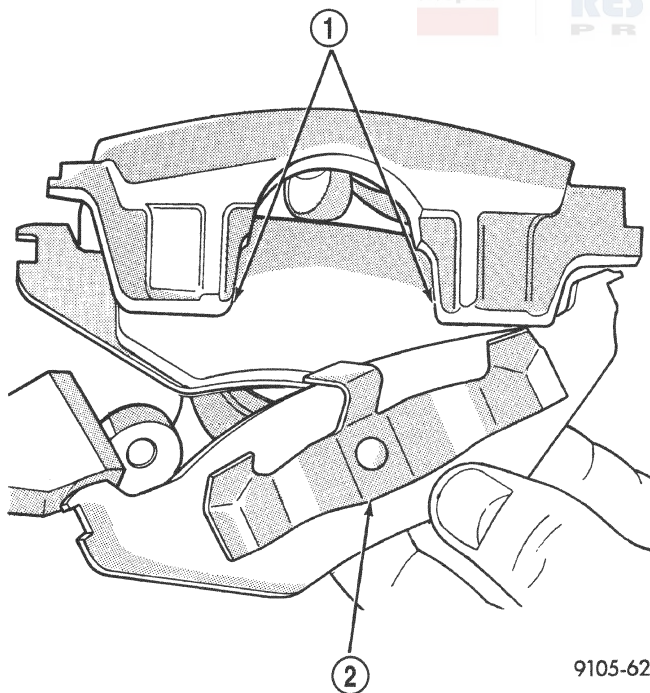
(4) Remove protective paper from noise suppression gasket on both inner and outer brake pad assemblies (if equipped).

(5) Install new inboard brake pad into caliper piston by firmly pressing it into bore of piston using thumbs (Fig. 98). **Be sure inboard brake shoe is positioned squarely against face of piston.**

(6) Slide new outboard brake pad onto the caliper (Fig. 98). Be sure retaining clip is squarely seated in the depressed areas on the caliper.

**CAUTION:** Use care when installing caliper assembly onto adapter, so the guide pin bushings and sleeves do not get damaged by the mounting bosses on adapter.

(7) Carefully lower caliper and brake shoes over rotor reversing the required removal procedure (Fig. 95). Make sure that caliper guide pin bolts, bushings and sleeves are clear of the adapter bosses.

**Fig. 98 Removing Outboard Brake Pad**

- 1 - CALIPER FINGERS
- 2 - RETAINING CLIP

**REMOVAL AND INSTALLATION (Continued)**

**CAUTION:** Extreme caution should be taken not to cross thread the caliper guide pin bolts when they are installed.

(8) Install caliper guide pin bolts into adapter. (Fig. 94). Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(9) Install the wheels and tires.

(10) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(11) Remove jackstands or lower hoist.

(12) Check brake fluid level.

**NOTE:** Before vehicle is moved after any brake service work, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

(13) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake pads.

**DRUM BRAKE WHEEL CYLINDER (REAR)**

**NOTE:** Before proceeding, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

**REMOVAL**

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Visually check the boots for cuts, tears, or heat cracks. If any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed.

(1) In case of a leak, remove brake shoes (replace if soaked with grease or brake fluid.)

(2) Disconnect rear brake flex hose tube from wheel cylinder and remove the flex hose routing bracket from the brake support plate (Fig. 100).

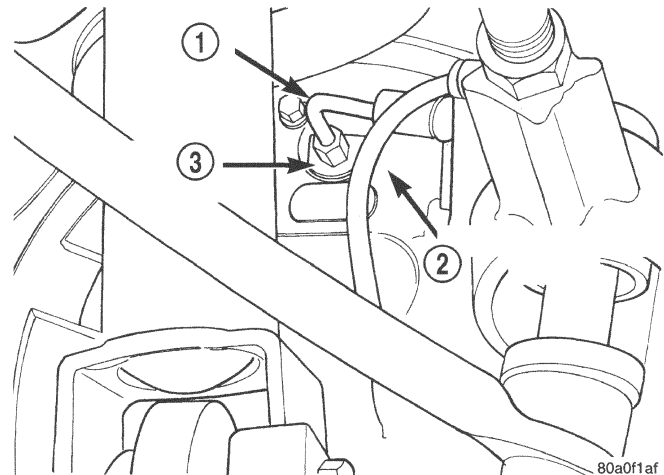
(3) Remove rear wheel cylinder attaching bolts (Fig. 101). Then pull wheel cylinder assembly off brake support plate.

**INSTALLATION**

(1) Apply a small bead of silicone sealer around the mating surface of the wheel cylinder to brake support plate.

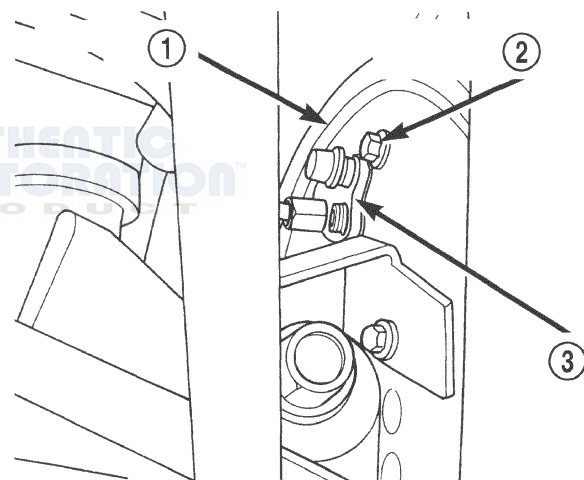
(2) Install wheel cylinder onto brake support plate. Tighten the attaching bolts (Fig. 101) to a torque of 13 N·m (115 in. lbs.).

(3) Hand start the hydraulic brake hose tube fitting into the wheel cylinder (Fig. 100). Tighten the tube nut to a torque of 17 N·m (145 in. lbs.).



**Fig. 100 Brake Flex Hose At Wheel Cylinder**

- 1 - FLEX HOSE TUBE
- 2 - BRAKE SUPPORT PLATE
- 3 - WHEEL CYLINDER



**Fig. 101 Wheel Cylinder Attaching Bolts**

- 1 - BRAKE SUPPORT PLATE
- 2 - WHEEL CYLINDER ATTACHING BOLTS (2)
- 3 - WHEEL CYLINDER

(4) Install brake shoes on support plate. Follow procedure for Installing Brake Shoe Assemblies in this section of the service manual.

(5) Install rear brake drum onto rear hub.

(6) Install the wheel and tire assembly. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(7) Adjust the rear brakes. See Adjusting Service Brakes in Service Adjustments section in this group of the service manual.



## REMOVAL AND INSTALLATION (Continued)

(8) Bleed the entire brake system. See Bleeding Brake System in Service Adjustments section in this group of the service manual.

### DRUM BRAKE SHOES (REAR)

**NOTE:** Before proceeding, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

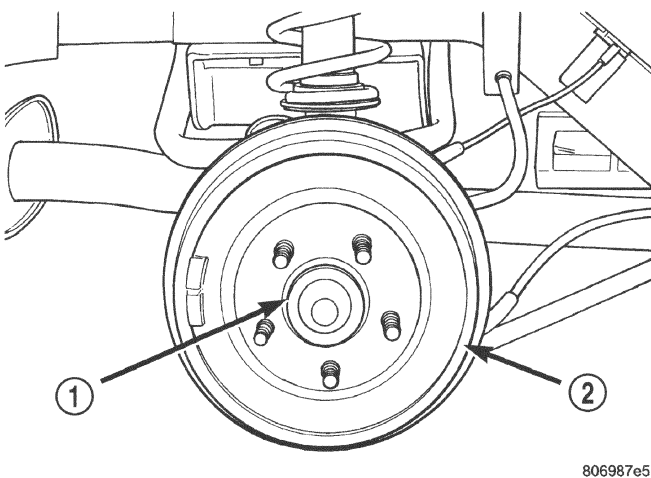
**NOTE:** When replacing the rear brake shoes on this vehicle, remove the brake shoes from only one side of the vehicle at a time. This is due to the automatic adjustment feature of the park brake system. If the brake shoe assemblies are removed from both rear wheels at the same time the adjuster will remove all the slack from the park brake cables, making installation of the brake shoes extremely difficult.

### REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove the rear wheel and tire assemblies from the vehicle.

(3) Remove rear brake drum to hub retaining clips (if equipped). Then remove rear brake drum from hub and bearing assembly (Fig. 102).

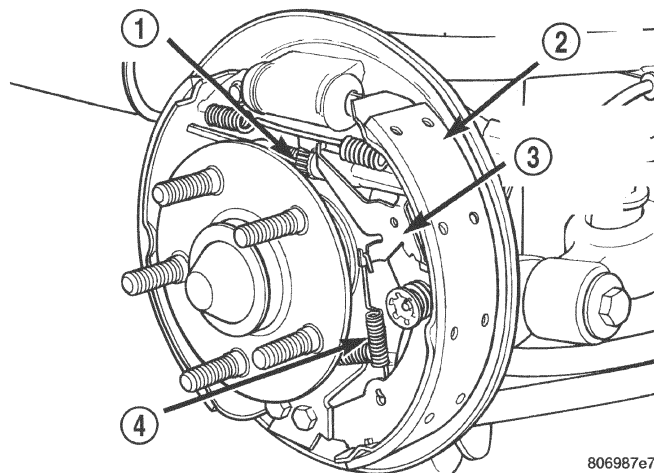


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**Fig. 102 Rear Brake Drum Assembly**

- 1 - HUB/BEARING ASSEMBLY
- 2 - BRAKE DRUM

(4) Remove the automatic adjuster lever actuating spring from the leading brake shoe (Fig. 103). Then remove the automatic adjuster actuating lever from the leading brake shoe (Fig. 103).

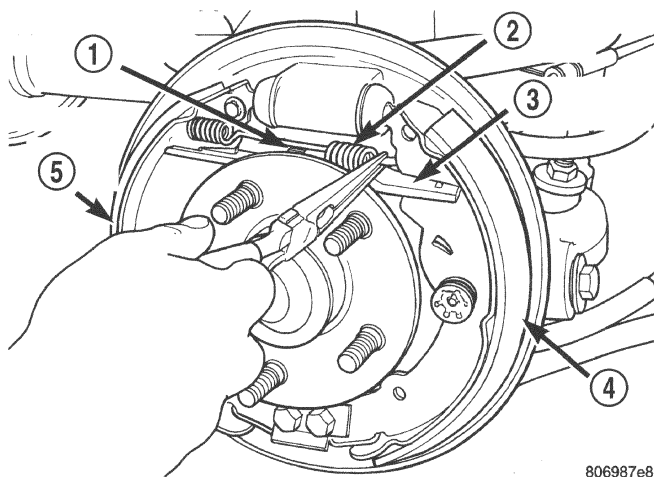


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**Fig. 103 Automatic Adjuster Actuating Spring And Lever**

- 1 - AUTOMATIC ADJUSTER
- 2 - LEADING BRAKE SHOE
- 3 - AUTOMATIC ADJUSTER ACTUATING LEVER
- 4 - AUTOMATIC ADJUSTER ACTUATING SPRING

(5) Thread the automatic adjuster star wheel (Fig. 104) all the way into the adjuster, removing all tension from the adjuster. Then remove the upper return spring (Fig. 104) from the brake shoes.



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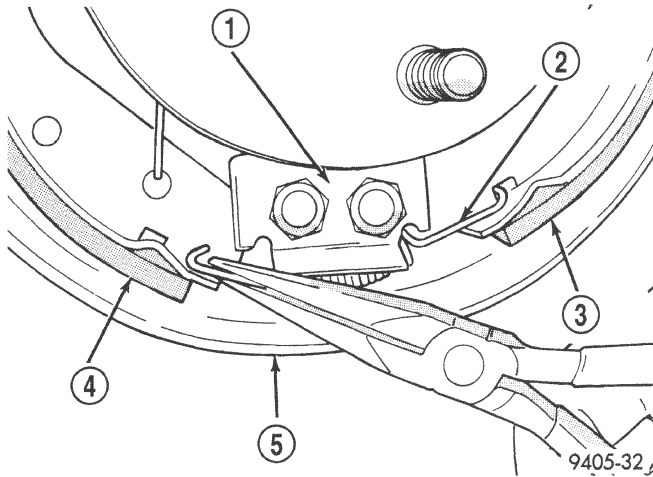
**Fig. 104 Brake Shoe Upper Return spring**

- 1 - ADJUSTER STAR WHEEL
- 2 - UPPER RETURN SPRING
- 3 - AUTOMATIC ADJUSTER
- 4 - LEADING BRAKE SHOE
- 5 - TRAILING BRAKE SHOE



**REMOVAL AND INSTALLATION (Continued)**

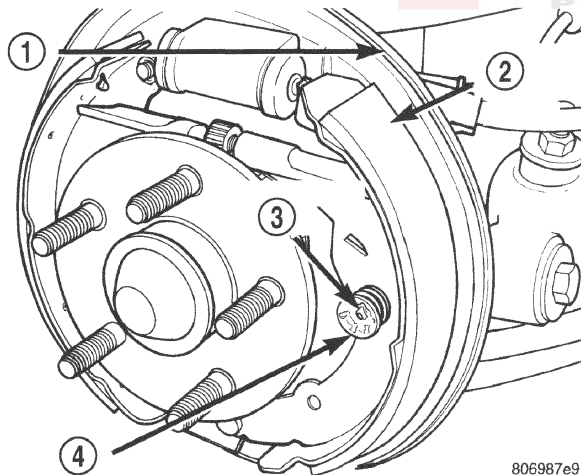
(6) Remove the brake shoe lower return spring (Fig. 105).



**Fig. 105 Brake Shoe Lower Return Spring**

- 1 - ANCHOR PLATE
- 2 - LOWER BRAKE SHOE RETURN SPRING
- 3 - REAR BRAKE SHOE
- 4 - FRONT BRAKE SHOE
- 5 - BRAKE SUPPORT PLATE

(7) Remove the hold down spring and attaching pin (Fig. 106) from the leading brake shoe.

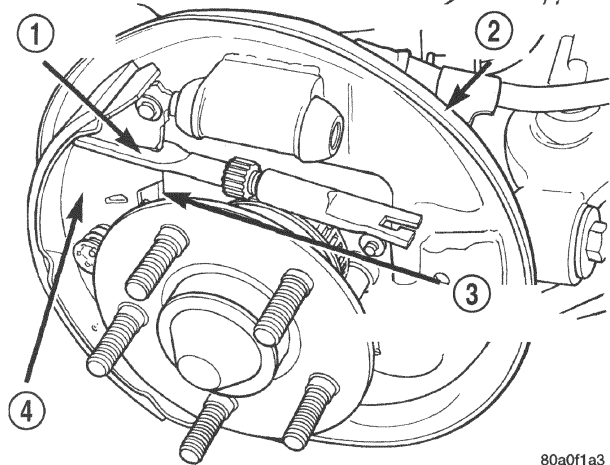


**Fig. 106 Hold Down Spring And Pin**

- 1 - BRAKE SUPPORT PLATE
- 2 - LEADING BRAKE SHOE
- 3 - ATTACHING PIN
- 4 - HOLD DOWN SPRING

(8) Remove the leading brake shoe from the brake support plate.

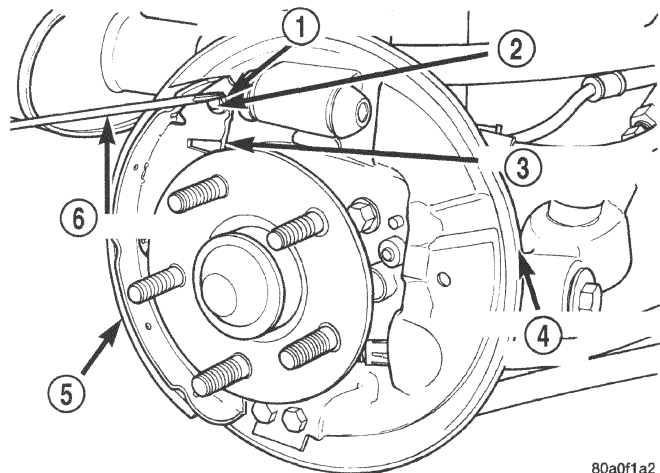
(9) Remove the automatic adjuster (Fig. 107) from the trailing brake shoe and park brake actuating lever.



**Fig. 107 Automatic Adjuster**

- 1 - AUTOMATIC ADJUSTER
- 2 - BRAKE SUPPORT PLATE
- 3 - PARK BRAKE ACTUATING LEVER
- 4 - TRAILING BRAKE SHOE

(10) Remove the retaining clip (Fig. 108) holding the park brake actuating lever to the trailing brake shoe.

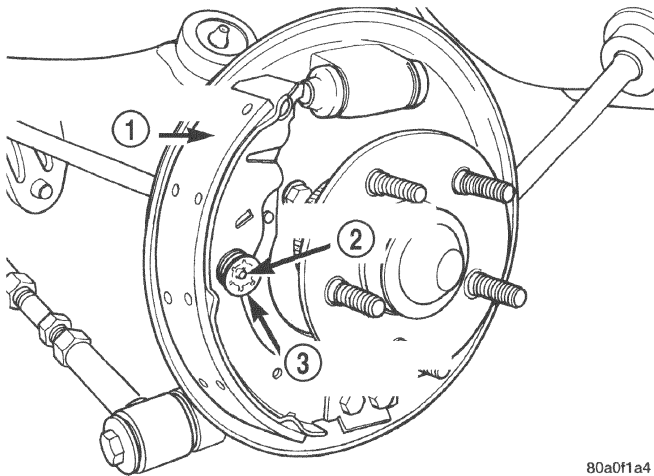


**Fig. 108 Park Brake Lever Retaining Clip**

- 1 - RETAINING CLIP
- 2 - PARK BRAKE LEVER PIN
- 3 - PARK BRAKE LEVER
- 4 - BRAKE SUPPORT PLATE
- 5 - TRAILING BRAKE SHOE
- 6 - SCREWDRIVER

**REMOVAL AND INSTALLATION (Continued)**

(11) Remove the hold down spring and attaching pin (Fig. 109) from the trailing brake shoe.

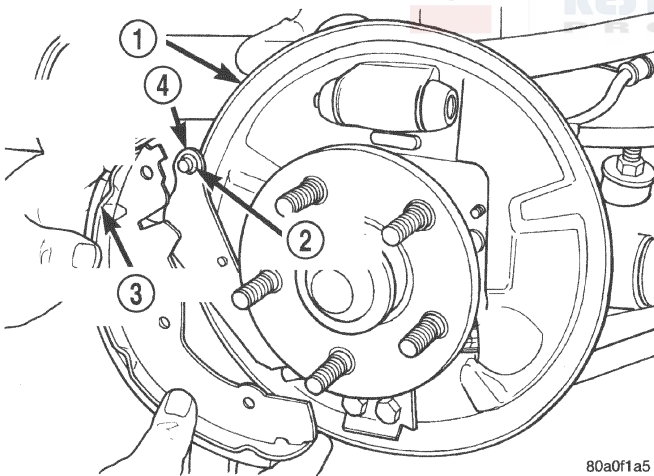


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**Fig. 109 Hold Down Spring And Pin**

- 1 - TRAILING BRAKE SHOE
- 2 - ATTACHING PIN
- 3 - HOLD DOWN SPRING

(12) Remove the trailing brake shoe from the brake support plate and the park brake actuating lever (Fig. 110).



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**Fig. 110 Remove /Install Trailing Brake Shoe**

- 1 - BRAKE SUPPORT PLATE
- 2 - WAVE WASHER
- 3 - TRAILING BRAKE SHOE
- 4 - PARK BRAKE ACTUATING LEVER

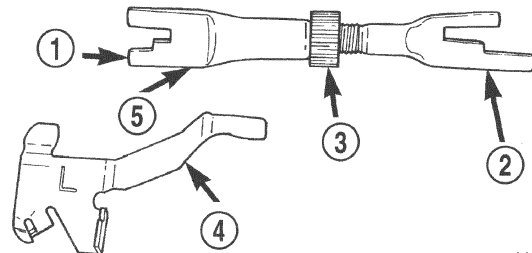
**CLEANING AND INSPECTION**

Clean metal portion of brake shoes. Check to see if shoes are bent.

Brake shoe lining should show contact across its entire width and from the heel to the toe of the lining, otherwise replace.

Shoes with lack of contact at toe or heel may be improperly ground.

Clean and inspect support and adjusting screws. Apply a thin coat of Mopar Multi-Purpose Lubricant or equivalent to the threads of the self adjuster (Fig. 111). Replace adjusting screw if corroded.



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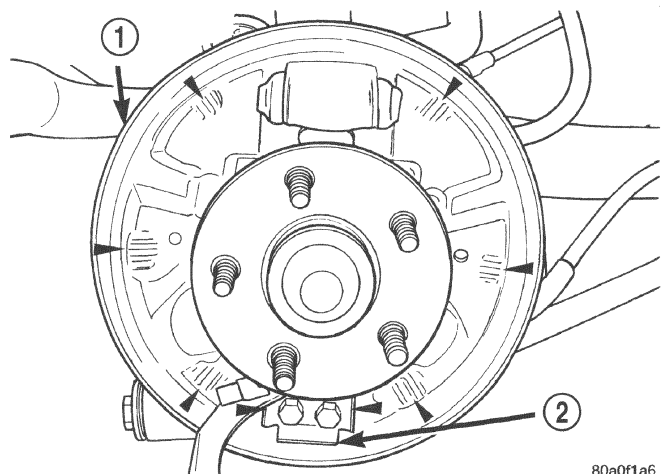
**Fig. 111 Adjuster Screw and Lever (Typical)**

- 1 - OUTBOARD FORWARD
- 2 - OUTBOARD REAR
- 3 - STAR WHEEL
- 4 - SELF ADJUSTER ACTUATING LEVER
- 5 - SELF ADJUSTER

If old springs have overheated or are damaged, replace. Overheating indications are paint discoloration or distorted end coils.

**INSTALLATION**

(1) Lubricate the six brake shoe contact areas on the brake support plate and the brake shoe contact points on the brake shoe anchor (Fig. 112) using Mopar Multi-Purpose Lubricant or equivalent.



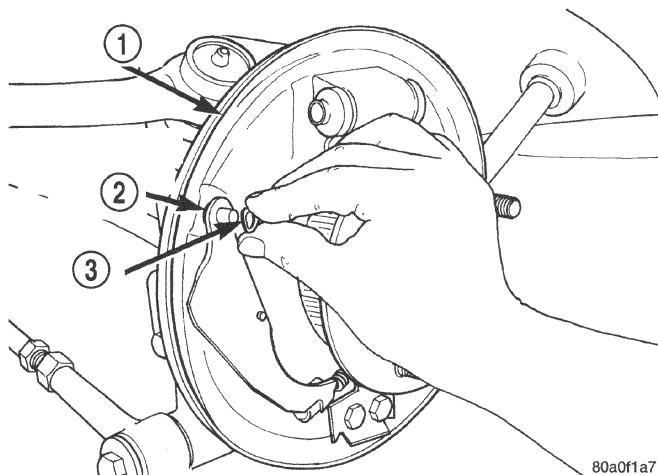
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**Fig. 112 Brake Shoe Contact Areas on Support Plate**

- 1 - BRAKE SUPPORT PLATE
- 2 - BRAKE SHOE ANCHOR

**REMOVAL AND INSTALLATION (Continued)**

(2) Install the wave washer on the pin of the park brake actuating lever (Fig. 113).



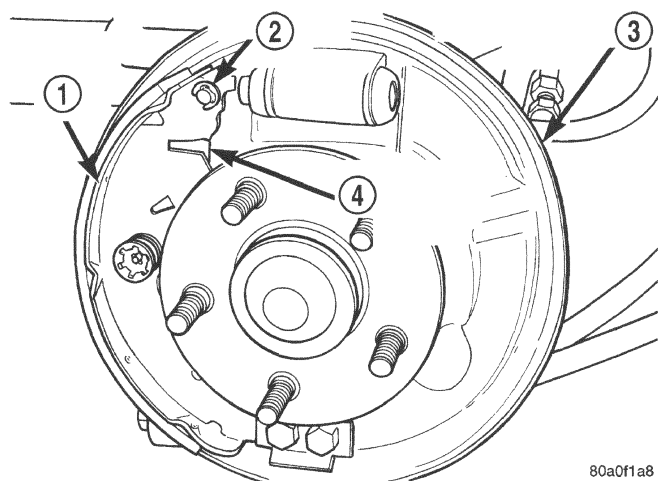
**Fig. 113 Wave Washer Installation**

- 1 - BRAKE SUPPORT PLATE
- 2 - PARK BRAKE ACTUATING LEVER
- 3 - WAVE WASHER

(3) Install the trailing brake shoe on the park brake actuating lever (Fig. 110)

(4) Install the trailing brake shoe on the brake support plate. Install the attaching pin and hold down spring for the trailing brake shoe (Fig. 109).

(5) Install the retaining clip attaching the park brake actuating lever to the trailing brake shoe (Fig. 114).



**Fig. 114 Park Brake Actuating Lever Retaining Clip Installed**

- 1 - TRAILING BRAKE SHOE
- 2 - RETAINING CLIP
- 3 - BRAKE SUPPORT PLATE
- 4 - PARK BRAKE ACTUATING LEVER

(6) Install the automatic adjuster on the trailing brake shoe and park brake actuating lever (Fig. 107).

(7) Install the leading brake shoe on the brake support plate. Then install the attaching pin and hold down spring for the leading brake shoe (Fig. 106).

(8) Install the brake shoe lower return spring (Fig. 105).

(9) Install the upper return spring on the brake shoes (Fig. 104)

(10) Install the automatic adjuster actuating lever and the actuating spring on the leading brake shoe (Fig. 103).

(11) Manually adjust the brake shoes assemblies out as far as possible but not so as to interfere with brake drum installation.

(12) Install the rear brake drums on the hubs.

(13) Adjust rear brake shoes per Adjusting Rear Brakes procedure in the service adjustments section of the service manual.

(14) Install the wheel and tire assembly.

(15) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(16) Road test vehicle. The automatic adjuster will continue the brake adjustment during the road test of the vehicle.

**BRAKE DRUM**

**NOTE:** Before proceeding, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

**REMOVAL**

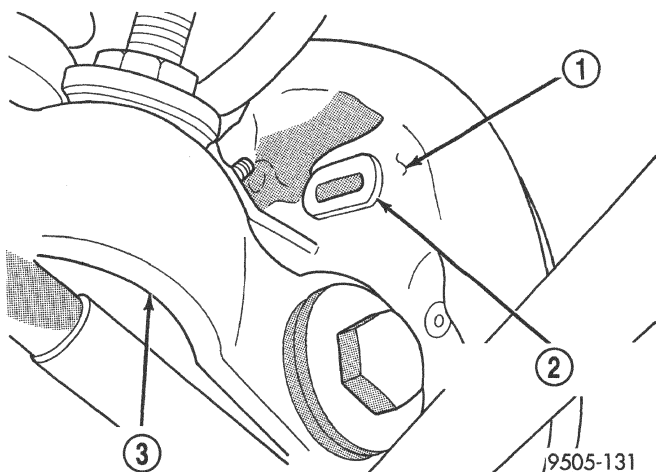
**NOTE:** If the vehicle has high mileage, the brake drums may have a ridge worn in them by the brake shoes. This ridge causes the brake drum to interfere with the brake shoes thus, not allowing the brake drum to be removed. Further clearance can be obtained by backing off the brakes automatic self-adjuster mechanism, using the following procedure in steps (1) and (2).

(1) Remove the rubber plug from the brake support plate (Fig. 115).

(2) Insert a screwdriver, through the automatic adjuster access hole, in the rear brake support plate (Fig. 116). Engage screwdriver with the teeth on the adjuster mechanism quadrant. Then rotate quadrant so that the teeth on the quadrant are moved toward the front of the vehicle (Fig. 116). This will back off the adjustment of the rear brake shoes.

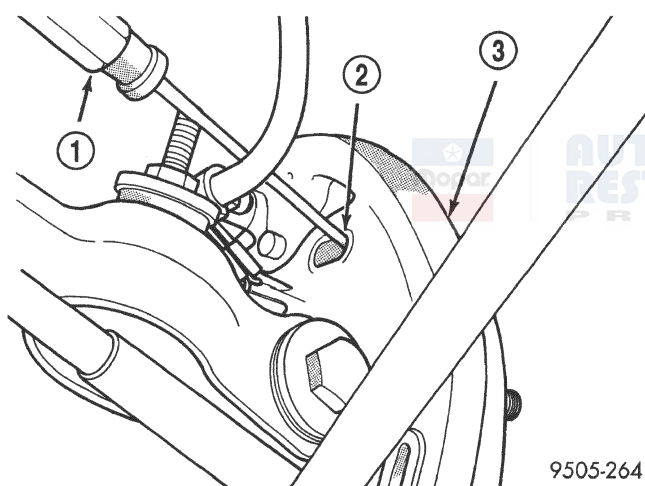


## REMOVAL AND INSTALLATION (Continued)



**Fig. 115 Automatic Adjuster Access Hole Plug**

- 1 - REAR BRAKE SUPPORT PLATE
- 2 - AUTOMATIC ADJUSTER ACCESS HOLE PLUG
- 3 - REAR SUSPENSION LATERAL LINK

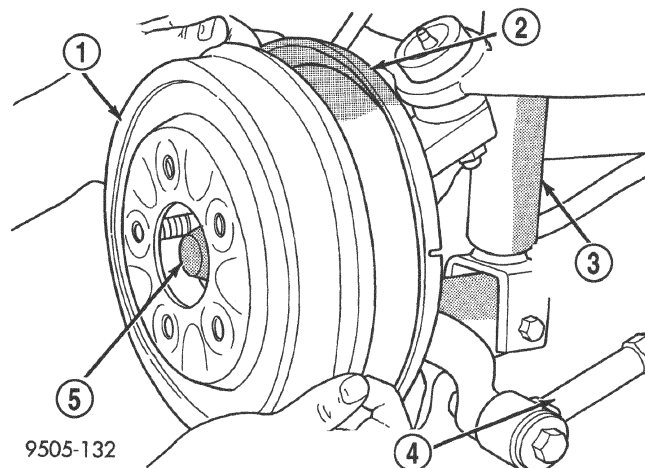


**Fig. 116 Backing Off Rear Brake Shoe Adjustment**

- 1 - SCREWDRIVER
- 2 - ACCESS HOLE
- 3 - BRAKE SUPPORT PLATE

(3) Remove any drum retainer clips from the wheel mounting studs.

(4) Remove rear brake drum from the rear hub and bearing assembly by pulling it straight off the wheel mounting studs (Fig. 117).



**Fig. 117 Brake Drum Removal**

- 1 - REAR BRAKE DRUM
- 2 - REAR BRAKE SUPPORT PLATE
- 3 - SHOCK ASSEMBLY
- 4 - REAR LATERAL ARM
- 5 - HUB/BEARING ASSEMBLY

## INSTALLATION

(1) Slide the drum onto the mounting studs and install rear brake drum on the rear hub and bearing assembly.

(2) Install the wheel and tire assembly.

(3) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(4) Adjust rear brakes. The rear brakes on this vehicle are adjusted by depressing the brake pedal as far as possible 2 or 3 times.

## DRUM BRAKE SUPPORT PLATE (REAR)

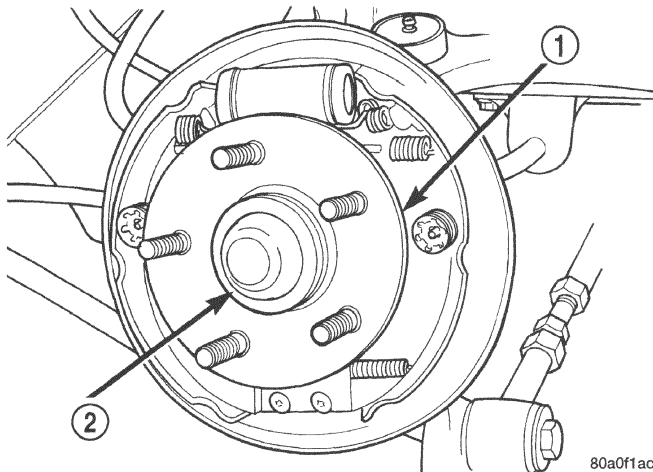
**NOTE:** Before proceeding, review **SERVICE WARNINGS AND CAUTIONS** at the beginning of **REMOVAL AND INSTALLATION** in this section.

**REMOVAL AND INSTALLATION (Continued)****REMOVAL**

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove rear tire and wheel assembly from vehicle.

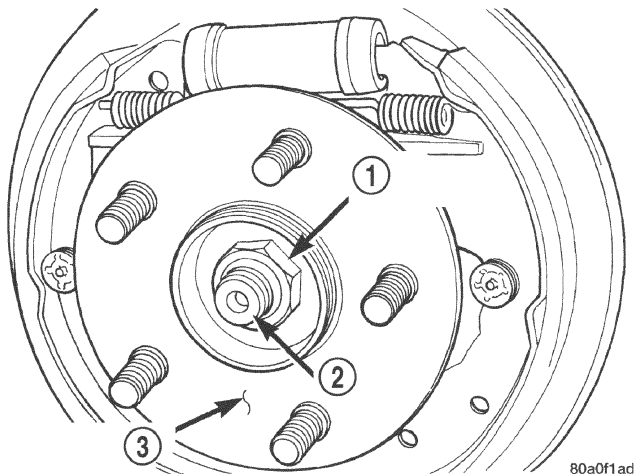
(3) Remove the dust cap from the rear hub and bearing assembly (Fig. 118).



**Fig. 118 Hub And Bearing Dust Cap**

- 1 - HUB/BEARING ASSEMBLY
- 2 - DUST CAP

(4) Remove the rear hub and bearing assembly retaining nut (Fig. 119). Then remove the hub and bearing assembly from the rear knuckle.



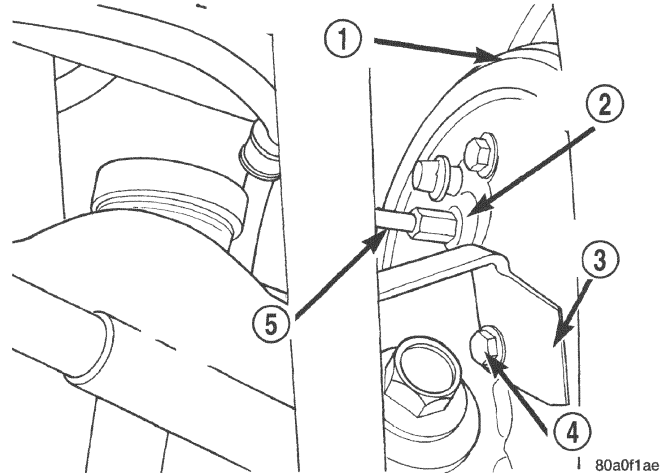
**Fig. 119 Hub And Bearing Retaining Nut**

- 1 - RETAINING NUT
- 2 - SPINDLE
- 3 - HUB/BEARING ASSEMBLY

(5) Remove the rear brake shoes from the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the

service manual for the proper brake shoe assembly removal procedure.

(6) Disconnect rear brake flex hose tube from wheel cylinder and remove the brake flex hose bracket from the brake support plate (Fig. 120).



**Fig. 120 Brake Flex Hose Tube At Wheel Cylinder**

- 1 - BRAKE SUPPORT PLATE
- 2 - WHEEL CYLINDER
- 3 - FLEX HOSE BRACKET
- 4 - BOLT
- 5 - FLEX HOSE TUBE

(7) Position a 1/2 wrench over the retainer fingers on the end of the parking brake cable (Fig. 121). Compress cable housing retaining fingers and start cable housing out of support plate (Fig. 121). Remove wrench when retainer is free from the park brake cable mounting hole in the rear brake support plate. Alternate method is to use a aircraft type hose clamp over cable housing end fitting compressing the three fingers.

(8) Remove the 4 bolts attaching the brake support plate to the knuckle. Separate brake support plate from rear suspension knuckle.

**INSTALLATION**

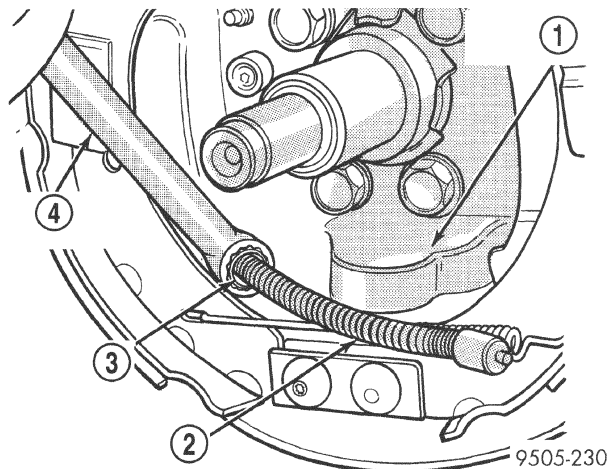
(1) Install the gasket and brake support plate on rear suspension knuckle. Torque the brake support plate to knuckle attaching bolts to 75 N·m (55 ft. lbs.).

(2) Insert parking brake cable end fitting into brake support plate.

(3) Hand start hydraulic brake hose tube fitting to wheel cylinder. Tighten tube nut to a torque of 17 N·m (145 in. lbs.).

(4) Install rear brake shoe assemblies on the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section in this group of the service manual for the proper brake shoe assembly installation procedure.

## REMOVAL AND INSTALLATION (Continued)



**Fig. 121 Removing Park Brake Cable From Support Plate**

- 1 - REAR BRAKE SUPPORT PLATE
- 2 - PARK BRAKE CABLE
- 3 - PARK BRAKE CABLE RETAINER
- 4 - 1/2" BOX END WRENCH

(5) Install rear hub and bearing assembly on rear knuckle. Install a **NEW** hub and bearing assembly retaining nut (Fig. 119). Tighten the hub and bearing assembly retaining nut to a torque of 250 N·m (185 ft. lbs.). Install dust cap.

(6) Adjust brake shoes assemblies so as not to interfere with brake drum installation.

(7) Install brake drum on rear hub/bearing assembly.

(8) Bleed the vehicle's base brakes hydraulic system.

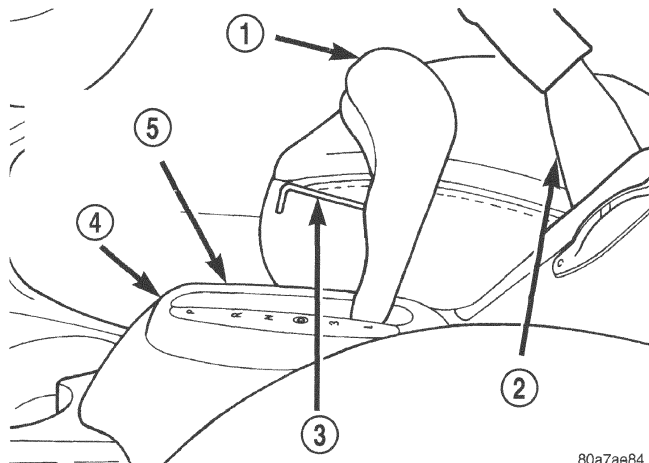
(9) After brake drums are installed, pump brake pedal several times to do final adjustment of the brake shoe assemblies.

(10) Install the wheel and tire assembly. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

## PARKING BRAKE LEVER

### REMOVAL

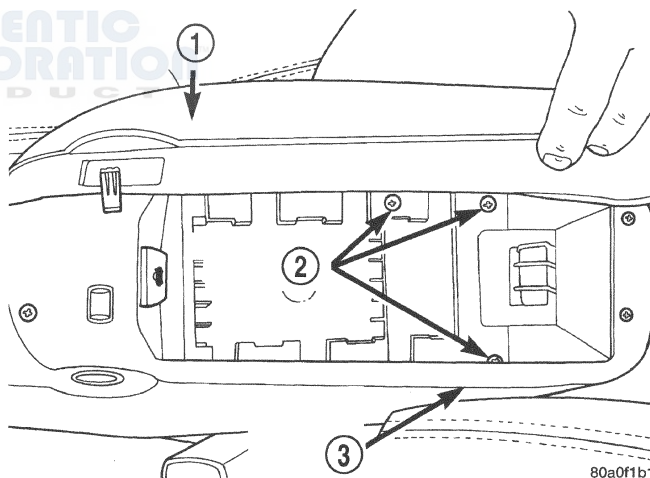
(1) Remove the shift knob from the shifter. **The shift knob is attached to the shifter using a set screw (Fig. 122). Access to the set screw is from the front of the shift knob and is removed using a 2 mm allen wrench.**



**Fig. 122 Shift Knob Retaining Screw**

- 1 - SHIFT KNOB
- 2 - PARK BRAKE LEVER
- 3 - ALLEN WRENCH
- 4 - CENTER CONSOLE
- 5 - TRANSMISSION RANGE INDICATOR

(2) Remove the 3 screws (Fig. 123) attaching the rear of the center console to the console bracket.



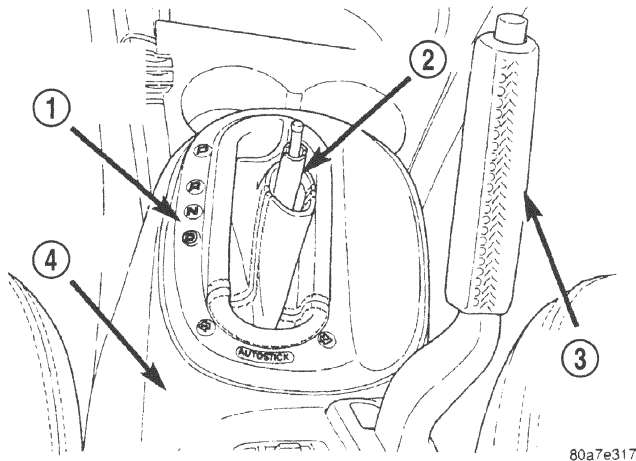
**Fig. 123 Center Console Rear Attaching Screws**

- 1 - CENTER CONSOLE COVER
- 2 - ATTACHING SCREWS
- 3 - CENTER CONSOLE



**REMOVAL AND INSTALLATION (Continued)**

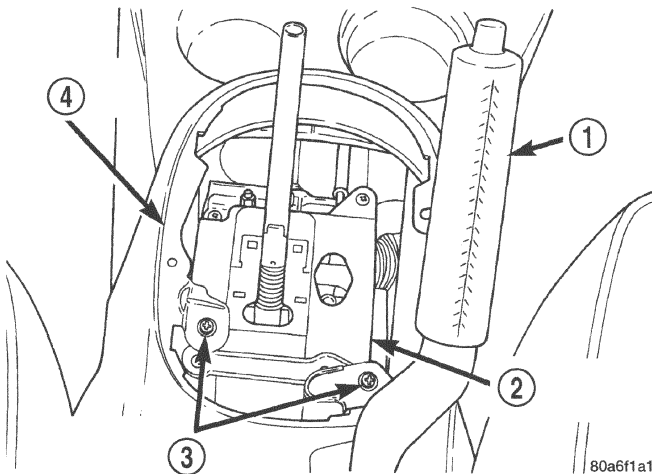
(3) Remove the shift range indicator from the center console. The shift range indicator is attached to the center console using retaining clips. It is removed by carefully prying it off the center console. The shift range indicator covers the 2 screws attaching the center console to the shifter mechanism. (Fig. 124).



**Fig. 124 Shift Range Indicator**

- 1 - SHIFT RANGE INDICATOR
- 2 - SHIFTER
- 3 - PARK BRAKE LEVER
- 4 - CENTER CONSOLE

(4) Remove the 2 screws (Fig. 125) attaching the center console to the shifter.

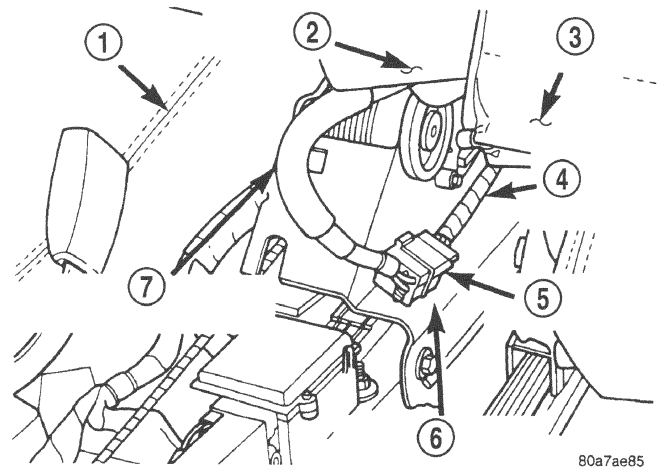


**Fig. 125 Center Console Front Attaching Screw**

- 1 - PARK BRAKE HAND LEVER
- 2 - GEARSHIFT MECHANISM
- 3 - ATTACHING SCREWS
- 4 - CENTER CONSOLE

(5) Raise the park brake hand lever to approximately a 45° angle. This is for the required clearance to remove the center console.

(6) Raise the rear of the center console high enough to access the center console wiring harness connector (Fig. 126). Disconnect the center console wiring harness connector from the vehicle wiring harness 10 way connector (Fig. 126).



**Fig. 126 Console Wiring Harness Connector**

- 1 - DRIVER SEAT
- 2 - CENTER CONSOLE
- 3 - PASSENGER SEAT
- 4 - VEHICLE WIRING HARNESS
- 5 - 10-WAY CONNECTOR
- 6 - PARK BRAKE LEVER ASSEMBLY
- 7 - CENTER CONSOLE WIRING HARNESS

- (7) Remove the center console from the vehicle.
- (8) Lower park brake lever handle.

**WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARK BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT RELEASE THE PARK BRAKE CABLES FROM THE EQUALIZER UNTIL THE AUTO ADJUSTER IS RELOADED. FAILURE TO RELOAD THE ADJUSTER MECHANISM BEFORE REMOVING PARK BRAKE CABLES FROM EQUALIZER COULD RESULT IN SERIOUS INJURY.**

(9) Reload the adjuster mechanism on the park brake lever using the following procedure.

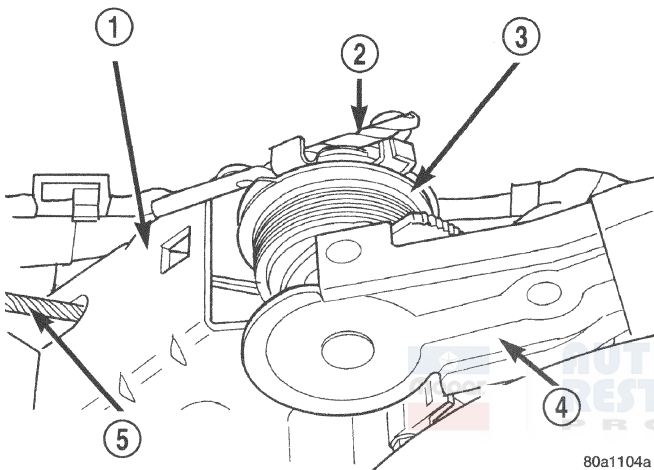
- Ensure the park brake lever is in the **full down position** when attempting to pull on park brake lever output cable (Fig. 127).
- Grasp the park brake lever output cable (Fig. 127) by hand and pull upward.
- Continue to pull upward on cable until a 15/64 drill bit can be inserted in the adjuster mechanism as shown in (Fig. 127). This will lock-out the auto adjuster mechanism removing the tension from the park brake lever output cable. This will then allow the rear park brake cables to be easily removed from the equalizer.

## REMOVAL AND INSTALLATION (Continued)

**NOTE:** If the output cable of the park brake mechanism will not move when pulled on, first, be sure the park brake lever is in the full down position. If park brake lever is in the full down position and the output cable will not move, use the following procedure to reload the adjuster mechanism.

Using a screw driver (Fig. 128) push down on the end of the clutch spring where shown (Fig. 128). While end of clutch spring is held down, pull outward on park brake mechanism output cable.

If output cable can not be pulled out of park brake mechanism, by pulling directly on output cable, use a screwdriver inserted in tension equalizer (Fig. 128) to assist in pulling on cable.



**Fig. 127 Park Brake Lever Correctly Reloaded**

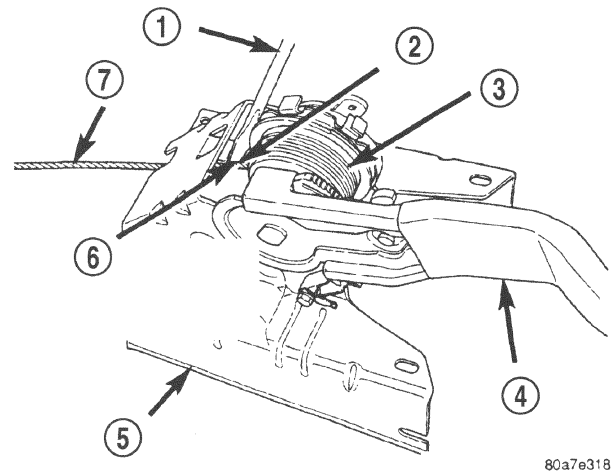
- 1 - PARK BRAKE LEVER ASSEMBLY
- 2 - 15/64 DRILL BIT
- 3 - AUTOMATIC ADJUSTER MECHANISM
- 4 - PARK BRAKE HAND LEVER
- 5 - PARK BRAKE LEVER OUTPUT CABLE

(10) Remove the rear wheel park brake cables from the park brake cable tension equalizer (Fig. 129).

**NOTE:** If auto adjuster was not reloaded before removing the tension equalizer from both rear park brake cables, (Fig. 128) the park brake lever output cable (Fig. 128) will be pulled into the park brake mechanism.

If this happens the auto adjuster can be reloaded using the following procedure.

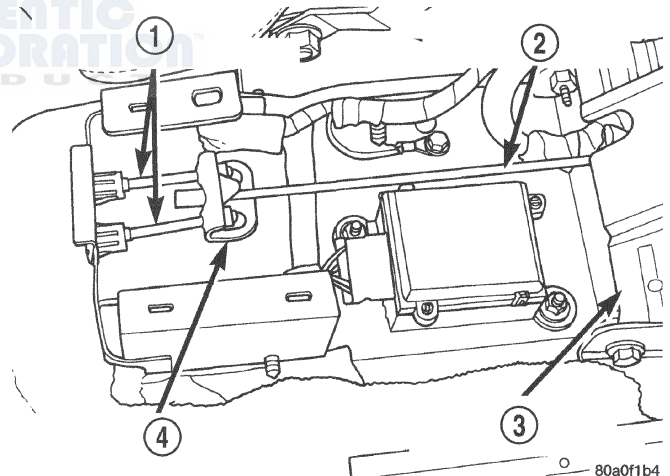
Using a screw driver (Fig. 128) push down on the end of the clutch spring where shown (Fig. 128). While the end of the clutch spring is held down, pull outward on park brake mechanism output cable. If output cable can not be pulled out of park brake mechanism, by pulling directly on output cable, use a screwdriver inserted in tension equalizer (Fig. 128) to assist in pulling on cable.



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**Fig. 128 Releasing Clutch Spring**

- 1 - SCREWDRIVER
- 2 - CLUTCH SPRING END
- 3 - CLUTCH SPRING
- 4 - PARK BRAKE HAND LEVER
- 5 - PARK BRAKE LEVER MECHANISM
- 6 - USING SCREWDRIVER PUSH DOWNWARD ON END OF CLUTCH SPRING HERE.
- 7 - PARK BRAKE LEVER OUTPUT CABLE



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**Fig. 129 Park Brake Cables At Tension Equalizer**

- 1 - REAR WHEEL PARK BRAKE CABLES
- 2 - PARK BRAKE LEVER OUTPUT CABLE
- 3 - PARK BRAKE LEVER ASSEMBLY
- 4 - PARK BRAKE CABLE TENSION EQUALIZER

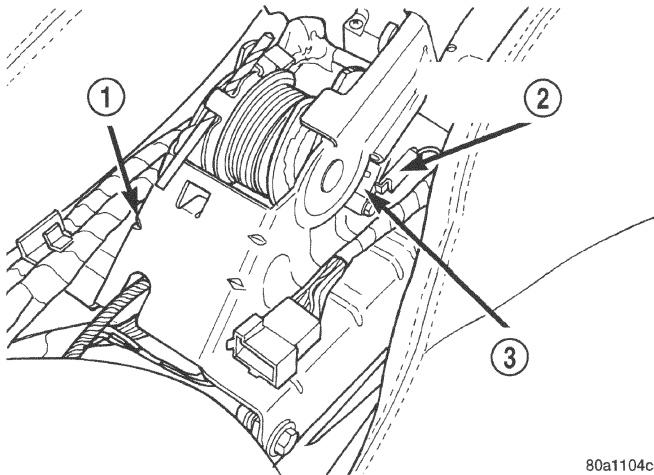
(11) Disconnect the wiring harness from the ground switch on the park brake lever (Fig. 130).

(12) Remove the wiring harness routing clips from both sides of the park brake mechanism bracket. Move the wiring harnesses out of the way.

**NOTE:** The mounting holes in the park brake lever bracket are slotted, which requires the mounting bolts to only be loosened but not removed.



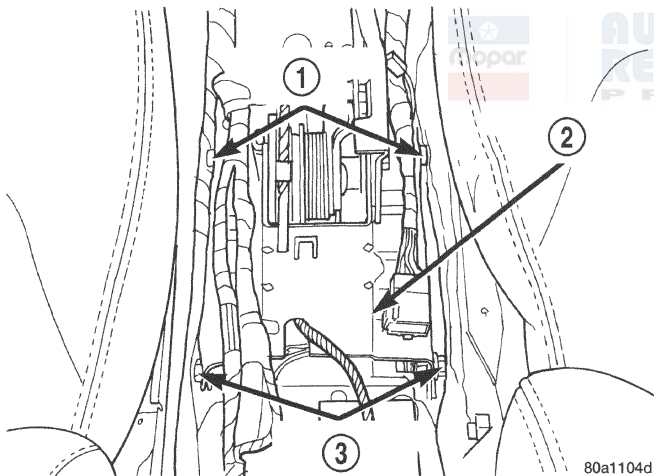
## REMOVAL AND INSTALLATION (Continued)



**Fig. 130 Wiring Harness Connection To Ground Switch**

- 1 - PARK BRAKE LEVER  
2 - WIRING HARNESS CONNECTOR  
3 - GROUND SWITCH

(13) Loosen **but do not remove** the 4 bolts attaching the park brake lever to the console bracket (Fig. 131).



**Fig. 131 Park Brake Lever Attaching Bolts**

- 1 - MOUNTING BOLTS  
2 - PARK BRAKE LEVER  
3 - MOUNTING BOLTS

(14) Remove the park brake lever assembly from console bracket using the following procedure. First rotate the back of the lever bracket upward off the 2 rear mounting bolts, then slide the lever bracket rearward off the front mounting bolts.

## INSTALLATION

**NOTE:** If the parking brake lever mounting bolts are not installed in the console bracket install them before installing the park brake lever on the console bracket.

(1) Install the parking brake lever on the console bracket using the following procedure. First slide the front of the park brake lever bracket on the 2 forward mounting bolts, then rotate the rear of the bracket downward onto the 2 rear mounting bolts. Tighten the 4 attaching bolts (Fig. 131) to a torque of 24 N·m (20 ft. lbs.).

(2) Install the rear park brake cables on the park brake cable tension equalizer (Fig. 129).

**WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARK BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT UNLOAD THE ADJUSTER MECHANISM USING A PROCEDURE OTHER THEN THE PROCEDURE IN Step 3 FAILURE TO UNLOAD THE ADJUSTER MECHANISM USING AN ALTERNATE PROCEDURE COULD RESULT IN SERIOUS INJURY.**

(3) Unload the adjuster mechanism on the park brake lever using the following procedure.

- Ensure the park brake lever is in the **full down position** when attempting to pull on park brake lever output cable (Fig. 127).

- Grasp the park brake lever output cable by hand and pull upward until all tension is removed from the drill bit used to reload the adjuster mechanism (Fig. 127).

- Remove the drill bit from the adjuster mechanism of the park brake lever (Fig. 127).

- Slowly release the park brake lever output cable until all slack is removed from the cable.

(4) Clip the wiring harness to the park brake lever bracket.

(5) Install the wiring harness connector on the ground switch of the park brake lever (Fig. 130).

(6) Cycle the park brake lever once from the released position to the fully applied position and then back to the released position. This will position the park brake cables and fully adjust them to their proper tension.

(7) Check the rear wheels of the vehicle with the park brake lever fully released, they should rotate freely without dragging.

(8) Raise the park brake hand lever to approximately a 45° angle. This is necessary for the required clearance to install the center console.

(9) Install the center console back in the vehicle.

(10) Install the wiring harness connector for the center console into the vehicle wiring harness (Fig. 126).

(11) Install the 2 screws attaching the front of the center console to the shifter. (Fig. 125).

(12) Install the 3 screws attaching the rear of the console to the console bracket (Fig. 123).

(13) Install the transmission range indicator (Fig. 124) in the center console.



## REMOVAL AND INSTALLATION (Continued)

(14) Install the shift knob on the shifter. Install and securely tighten the shift knob retaining screw (Fig. 132).

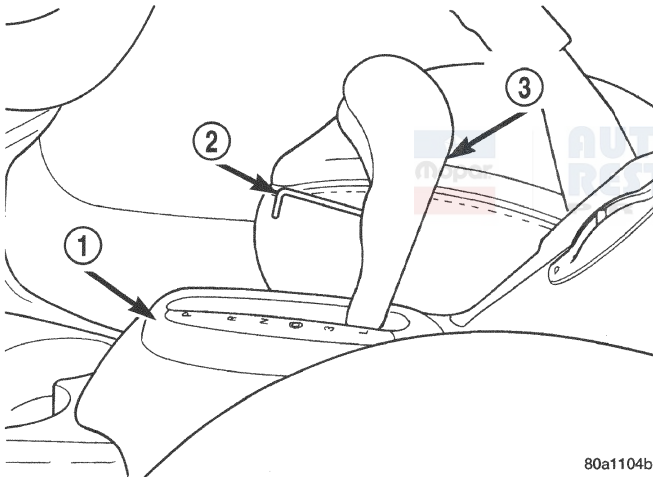
### PARKING BRAKE CABLE (REAR)

**NOTE:** Remove only one rear parking brake cable from the vehicle at a time. Failure to do so will result in high efforts required to connect the parking brake cables to the tension equalizer and the parking brake lever at the rear wheel brakes.

For servicing of either the left or right rear parking brake cable, follow the procedure as listed below.

### REMOVAL

(1) Remove the shift knob from the shifter. **The gear shift knob is attached to the shifter using a set screw (Fig. 132). Access to the set screw is from the front of the shift knob and is removed using a 2 mm allen wrench.**



**Fig. 132 Shift Knob Retaining Screw**

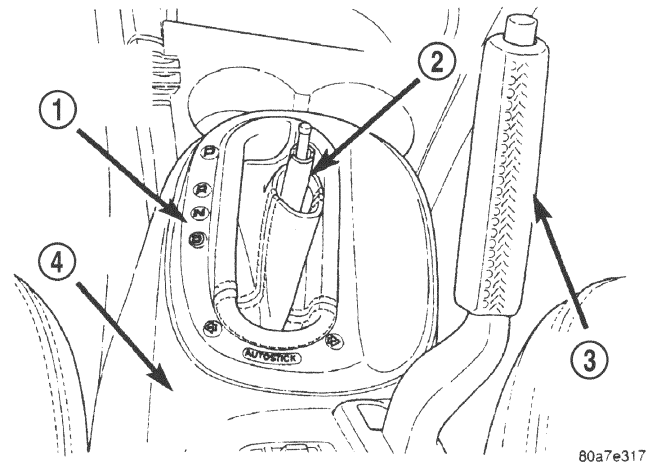
- 1 - CENTER CONSOLE
- 2 - ALLEN WRENCH
- 3 - SHIFT KNOB

(2) Remove the shift range indicator (Fig. 133) from the center console. The shift range indicator is attached to the center console using retaining clips. It is removed by carefully prying it off the center console. The shift range indicator covers the 2 attaching screws for the center console.

(3) Remove the 2 screws (Fig. 134) attaching the center console to the shifter.

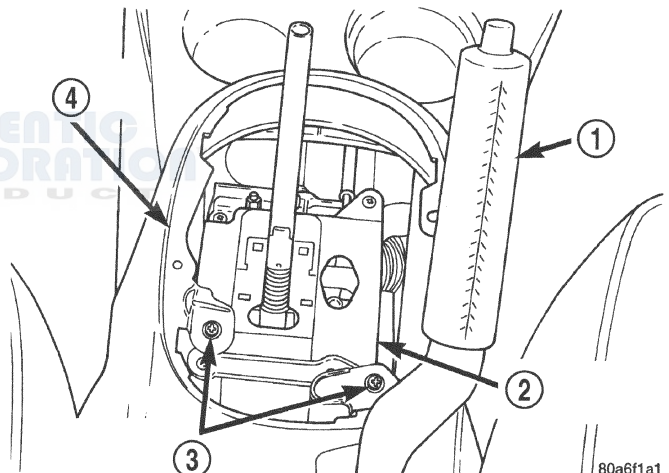
(4) Remove the 3 screws attaching the rear of the center console to the console bracket (Fig. 135).

(5) Raise the park brake lever to a 45° angle. This is required for clearance to remove the center console.



**Fig. 133 Shift Range Indicator**

- 1 - SHIFT RANGE INDICATOR
- 2 - SHIFTER
- 3 - PARK BRAKE LEVER
- 4 - CENTER CONSOLE



**Fig. 134 Center Console Front Attaching Screw**

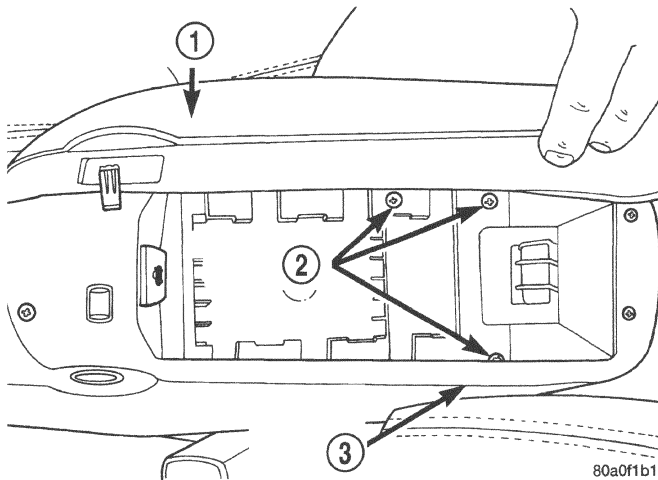
- 1 - PARK BRAKE HAND LEVER
- 2 - GEARSHIFT MECHANISM
- 3 - ATTACHING SCREWS
- 4 - CENTER CONSOLE

(6) Raise the rear of the center console high enough to access the center console wiring harness connector (Fig. 136). Disconnect the center console wiring harness connector from the vehicle wiring harness 10-way connector (Fig. 136).

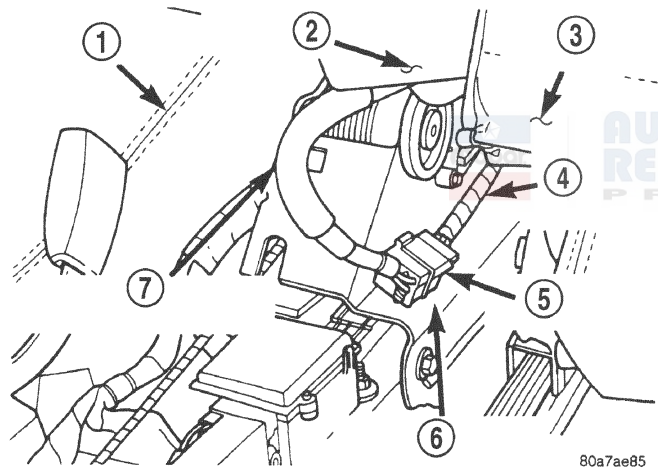
(7) Remove the center console from the vehicle.

(8) Lower the park brake lever to its fully released position.

## REMOVAL AND INSTALLATION (Continued)

**Fig. 135 Center Console Rear Attaching Screws**

- 1 - CENTER CONSOLE COVER
- 2 - ATTACHING SCREWS
- 3 - CENTER CONSOLE

**Fig. 136 Console Wiring Harness Connector**

- 1 - DRIVER SEAT
- 2 - CENTER CONSOLE
- 3 - PASSENGER SEAT
- 4 - VEHICLE WIRING HARNESS
- 5 - 10-WAY CONNECTOR
- 6 - PARK BRAKE LEVER ASSEMBLY
- 7 - CENTER CONSOLE WIRING HARNESS

**WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARK BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT RELEASE THE PARK BRAKE CABLES FROM THE EQUALIZER UNTIL THE AUTO ADJUSTER IS RELOADED. FAILURE TO RELOAD THE ADJUSTER MECHANISM BEFORE REMOVING PARK BRAKE CABLES FROM EQUALIZER COULD RESULT IN SERIOUS INJURY.**

(9) Reload the adjuster mechanism on the park brake lever using the following procedure.

- Ensure the park brake lever is in the **full down position** when attempting to pull on park brake lever output cable (Fig. 137).

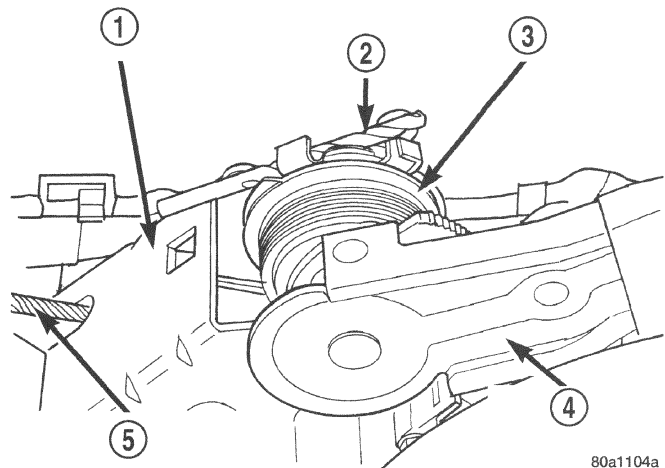
- Grasp the park brake lever output cable (Fig. 137) by hand and pull upward.

- Continue to pull upward on cable until a 15/64 drill bit can be inserted in the adjuster mechanism as shown in (Fig. 137). This will lock-out the auto adjuster mechanism removing the tension from the park brake lever output cable. This will then allow the rear park brake cables to be easily removed from the equalizer.

**NOTE: If the output cable of the park brake mechanism will not move when pulled on, first, be sure the park brake lever is in the full down position. If park brake lever is in the full down position and the output cable will not move, use the following procedure to reload the adjuster mechanism.**

Using a screw driver (Fig. 138) push down on the end of the clutch spring where shown (Fig. 138). While end of clutch spring is held down, pull outward on park brake mechanism output cable.

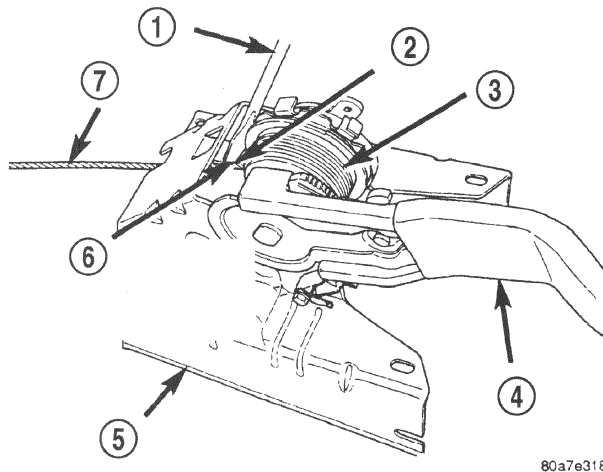
If output cable can not be pulled out of park brake mechanism, by pulling directly on output cable, use a screwdriver inserted in tension equalizer (Fig. 138) to assist in pulling on cable.

**Fig. 137 Park Brake Lever Correctly Reloaded**

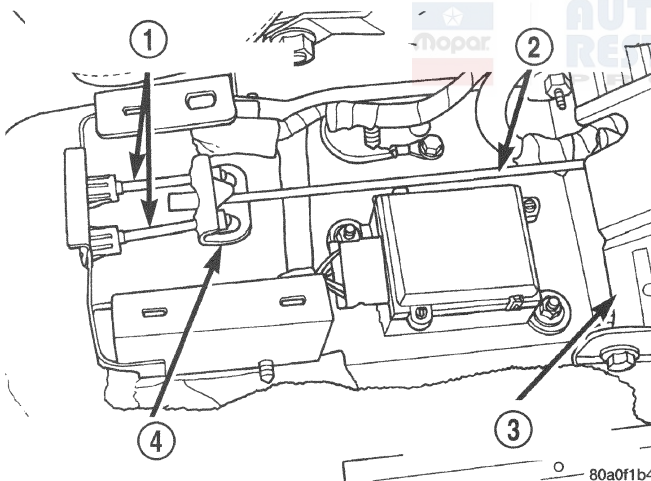
- 1 - PARK BRAKE LEVER ASSEMBLY
- 2 - 15/64 DRILL BIT
- 3 - AUTOMATIC ADJUSTER MECHANISM
- 4 - PARK BRAKE HAND LEVER
- 5 - PARK BRAKE LEVER OUTPUT CABLE

(10) Remove both rear wheel park brake cables from the park brake cable tension equalizer (Fig. 139).

## REMOVAL AND INSTALLATION (Continued)

**Fig. 138 Releasing Clutch Spring**

- 1 - SCREWDRIVER
- 2 - CLUTCH SPRING END
- 3 - CLUTCH SPRING
- 4 - PARK BRAKE HAND LEVER
- 5 - PARK BRAKE LEVER MECHANISM
- 6 - USING SCREWDRIVER PUSH DOWNWARD ON END OF CLUTCH SPRING HERE.
- 7 - PARK BRAKE LEVER OUTPUT CABLE

**Fig. 139 Park Brake Cables At Tension Equalizer**

- 1 - REAR WHEEL PARK BRAKE CABLES
- 2 - PARK BRAKE LEVER OUTPUT CABLE
- 3 - PARK BRAKE LEVER ASSEMBLY
- 4 - PARK BRAKE CABLE TENSION EQUALIZER

**NOTE:** If auto adjuster was not reloaded before removing the tension equalizer from both rear park brake cables, (Fig. 139) the park brake lever output cable (Fig. 139) will be pulled into the park brake mechanism.

If this happens the auto adjuster can be reloaded using the following procedure.

Using a screw driver (Fig. 138) push down on the end of the clutch spring where shown (Fig. 138).

While end of clutch spring is held down, pull outward on park brake mechanism output cable. If output cable can not be pulled out of park brake mechanism, by pulling directly on output cable, use a screwdriver inserted in tension equalizer (Fig. 138) to assist in pulling on cable.

(11) Remove the rear seat lower cushion from the vehicle.

(12) Remove scuff plates from right and left door sills. Scuff plates are attached to door sills using clips on bottom of scuff plates. Remove by carefully prying scuff plate retaining clips out of door sills.

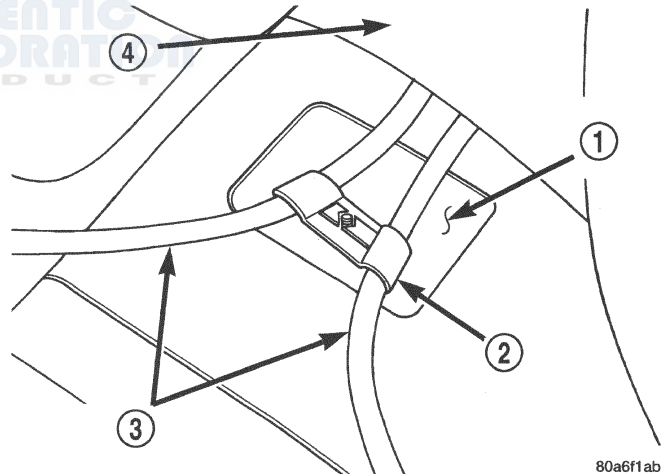
(13) Remove the quarter trim panel from both sides of the vehicle. Refer to Group 23 Body in this group of the service manual for the required removal procedure.

(14) Remove the 2 wiring harness routing clips from the cross car beam.

(15) Remove the 2 clips attaching the carpeting to the cross car beam.

(16) Fold rear carpeting forward to expose park brake cables.

(17) Remove the routing clip (Fig. 140) attaching the rear park brake cables to the floor pan.

**Fig. 140 Park Brake Cable Attachment To Floor Pan**

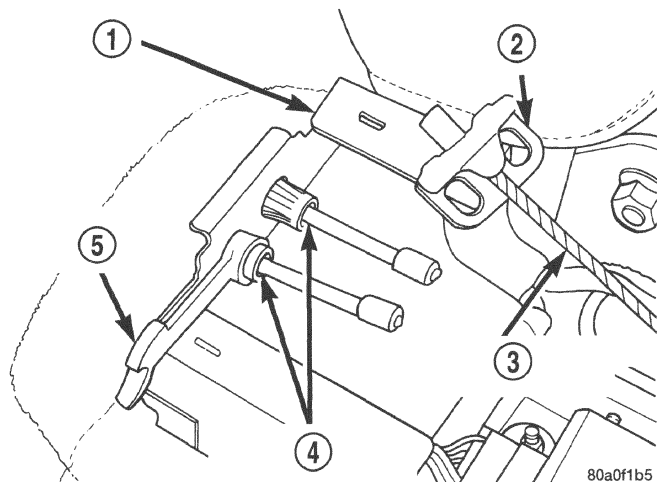
- 1 - FLOOR PAN
- 2 - ROUTING CLIP
- 3 - REAR PARK BRAKE CABLES
- 4 - VEHICLE CARPETING

(18) Install the box end of a 1/2 in. wrench over the park brake cable retainer as indicated in (Fig. 141). This will compress tabs on park brake cable retainer, allowing cable to be removed from console bracket. From under carpet, grasp park brake cable housing and pull cable straight out of console bracket.

(19) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubri-



## REMOVAL AND INSTALLATION (Continued)



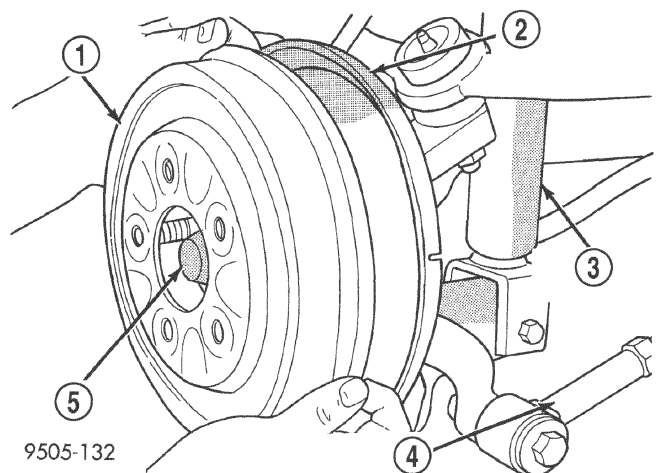
**Fig. 141 Compressing Park Brake Cable Retaining Tabs**

- 1 - CONSOLE BRACKET
- 2 - PARK BRAKE CABLE TENSION EQUALIZER
- 3 - PARK BRAKE LEVER OUTPUT CABLE
- 4 - REAR PARK BRAKE CABLES
- 5 - 1/2" BOX END WRENCH

cation and Maintenance section of this manual for the required lifting procedure to be used for this vehicle.

(20) Remove rear wheel and tire assembly from the side of the vehicle requiring park brake cable service.

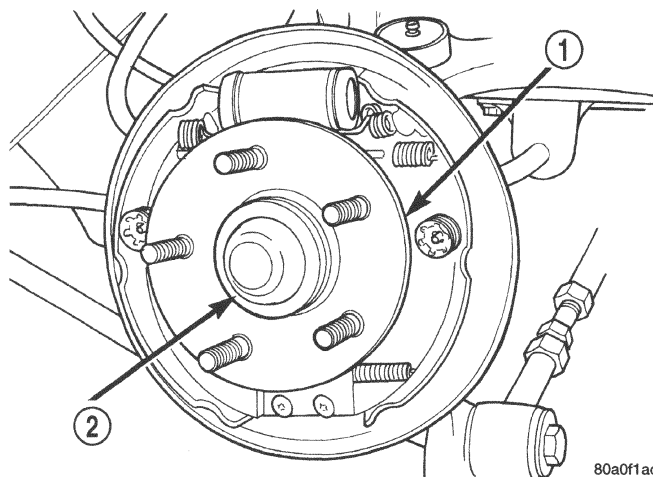
(21) Remove the rear brake drum (Fig. 142) from the rear hub/bearing assembly.



**Fig. 142 Rear Brake Drum**

- 1 - REAR BRAKE DRUM
- 2 - REAR BRAKE SUPPORT PLATE
- 3 - SHOCK ASSEMBLY
- 4 - REAR LATERAL ARM
- 5 - HUB/BEARING ASSEMBLY

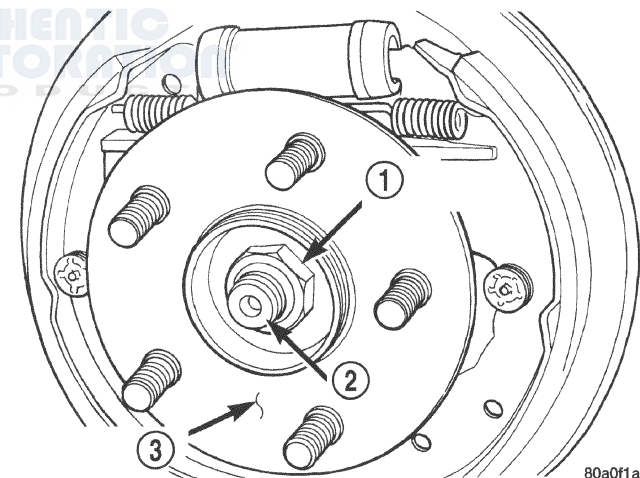
(22) Remove the dust cap (Fig. 143) from the rear hub/bearing assembly.



**Fig. 143 Rear Hub/Bearing Dust Cap**

- 1 - HUB/BEARING ASSEMBLY
- 2 - DUST CAP

(23) Remove the rear hub/bearing retaining nut (Fig. 144).



**Fig. 144 Hub/Bearing Retaining Nut**

- 1 - RETAINING NUT
- 2 - SPINDLE
- 3 - HUB/BEARING ASSEMBLY

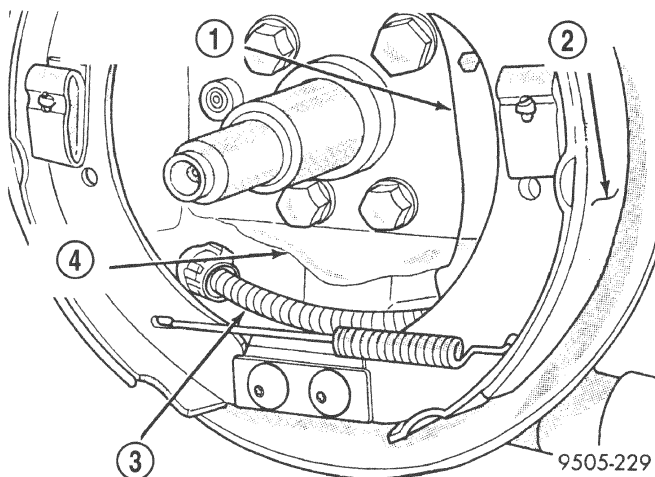
(24) Remove the hub/bearing from the spindle.

(25) Remove the park brake cable from the park brake actuating lever on the trailing brake shoe (Fig. 145).

(26) Remove park brake cable (Fig. 146) from rear brake support plate. Park brake cable is removed from brake support plate using a 1/2 in. wrench as shown in (Fig. 146) to compress locking tabs on park brake cable retainer.

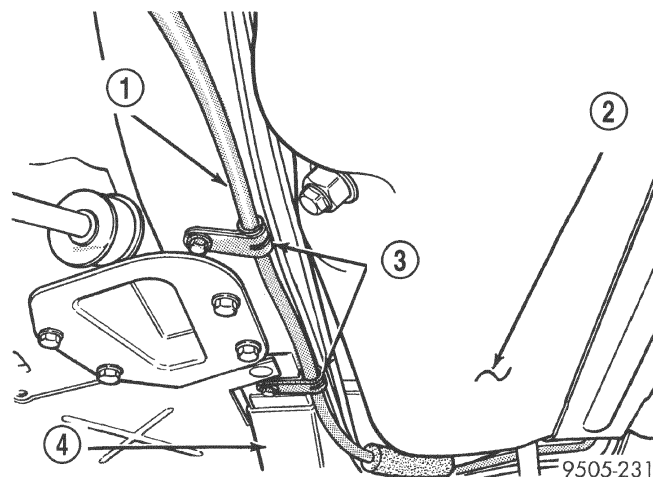
(27) Raise vehicle.

## REMOVAL AND INSTALLATION (Continued)



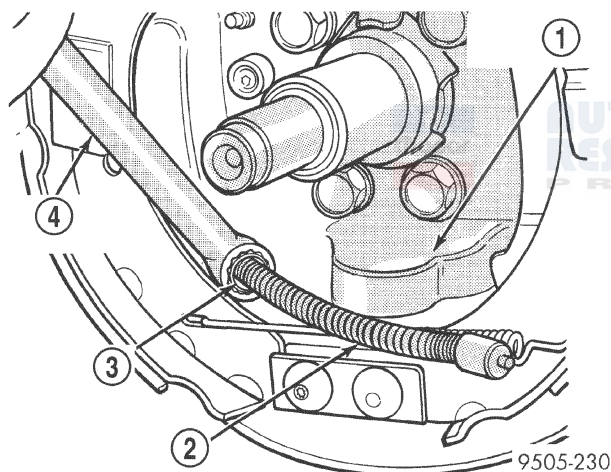
**Fig. 145 Rear Park Brake Cable At Actuating Lever**

- 1 - PARK BRAKE ACTUATING LEVER
- 2 - TRAILING BRAKE SHOE
- 3 - PARK BRAKE CABLE
- 4 - BRAKE SUPPORT PLATE



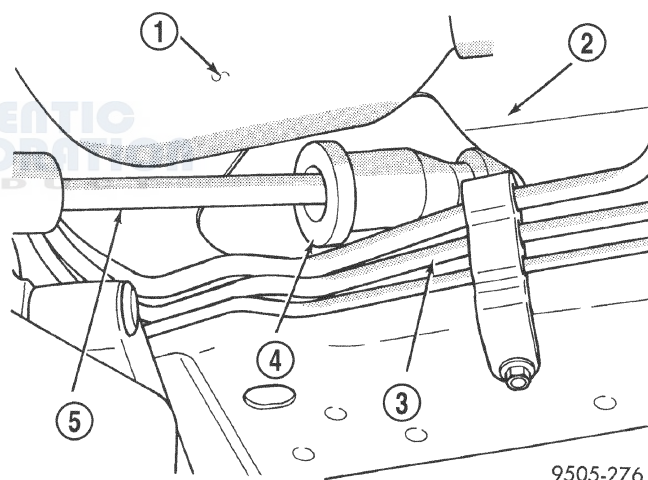
**Fig. 147 Park Brake Cable Routing Brackets**

- 1 - PARK BRAKE CABLE
- 2 - FUEL TANK
- 3 - ROUTING BRACKETS
- 4 - FRAME RAIL



**Fig. 146 Park Brake Cable Removal From Brake Support Plate**

- 1 - REAR BRAKE SUPPORT PLATE
- 2 - PARK BRAKE CABLE
- 3 - PARK BRAKE CABLE RETAINER
- 4 - 1/2" BOX END WRENCH



**Fig. 148 Park Brake Cable Removal / Installation At Floor Pan**

- 1 - FUEL TANK
- 2 - VEHICLE FLOOR PAN
- 3 - FUEL LINES
- 4 - SEALING GROMMET
- 5 - PARK BRAKE CABLE

(28) Remove the 2 routing brackets (Fig. 147) attaching the park brake cable to the vehicle frame rail.

(29) Remove the park brake cable and sealing grommet (Fig. 148) from the floor pan of the vehicle.

## INSTALLATION

(1) Install the parking brake cable into the floor pan. Make sure sealing grommet on park brake cable (Fig. 148) is installed in floor pan as far as possible to insure a proper seal.

(2) Install the 2 parking brake cable routing brackets (Fig. 147) on the frame rail. Install and securely tighten the routing bracket attaching bolts.

(3) Install the park brake cable into the rear brake support plate **but do not** lock the locking tabs on the cable attachment retainer into the brake support plate.

(4) Install the park brake cable on the park brake actuating lever of the trailing brake shoe (Fig. 145).



## REMOVAL AND INSTALLATION (Continued)

Be sure the end of the spring is under the lip on the park brake actuating lever.

(5) Push the park brake cable fully into the rear brake support plate. Be sure locking tabs on cable retainer are expanded to ensure park brake cable is securely held in the support plate.

(6) Install hub/bearing assembly on rear spindle. Then install a new rear hub/bearing assembly retaining nut (Fig. 144). Torque hub/bearing assembly to spindle retaining nut to 250 N·m (185 ft. lbs.).

(7) Install hub/bearing assembly dust cap, (Fig. 143) using a soft faced hammer.

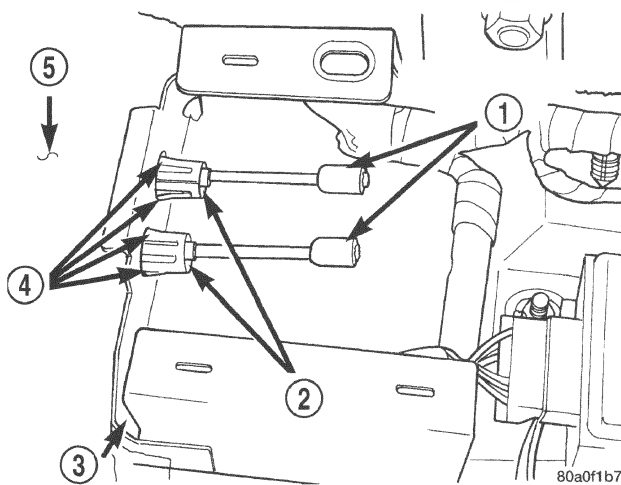
(8) Install the rear brake drum on the hub/bearing assembly (Fig. 142).

(9) Install rear wheel and tire assembly on vehicle. Tighten all wheel stud nuts in criss cross pattern to one-half specified torque. Then repeat pattern, fully tightening stud nuts to 135 N·m (100 ft. lbs.).

(10) Lower vehicle.

(11) Grasp park brake cable to floor pan seal grommet by hand and pull it into the floor pan to ensure seal grommet is fully seated into the floor pan.

(12) Route park brake cable under carpeting and up to park brake cable hole in console bracket on floor pan. Then install park brake cable into console bracket (Fig. 149). Be sure tabs (Fig. 149) on park brake cable retainer, have expanded out to hold park brake cable in console bracket.



**Fig. 149 Park Brake Cables Installed In Console Bracket**

- 1 - PARK BRAKE CABLES
- 2 - PARK BRAKE CABLE RETAINERS
- 3 - CONSOLE BRACKET
- 4 - RETAINING TABS
- 5 - CARPETING

(13) Install the routing bracket holding park brake cables to the floor pan of the vehicle (Fig. 140).

**WARNING: THE AUTO ADJUSTING FEATURE OF THIS PARK BRAKE LEVER CONTAINS A CLOCK SPRING LOADED TO APPROXIMATELY 20 POUNDS. DO NOT UNLOAD THE ADJUSTER MECHANISM USING A PROCEDURE OTHER THEN THE PROCEDURE IN Step 14 FAILURE TO UNLOAD THE ADJUSTER MECHANISM USING AN ALTERNATE PROCEDURE COULD RESULT IN SERIOUS INJURY.**

(14) Unload the adjuster mechanism on the park brake lever using the following procedure. Grasp the park brake lever output cable by hand and pull upward until all tension is removed from the drill bit (Fig. 137). used to reload the adjuster mechanism. Remove the drill bit from the clock spring of the park brake lever adjuster mechanism. Then, slowly release the park brake lever output cable until all slack is removed from the cable.

(15) Clip the wiring harness to the park brake lever bracket.

(16) Install the wiring harness connector on the ground switch of the park brake lever.

(17) Cycle the park brake lever once from the released position to the fully applied position and then back to the released position. This will position the park brake cables and fully adjust them to thier proper tension.

(18) Check the rear wheels of the vehicle with the park brake lever fully released, they should rotate freely without dragging.

(19) Raise the park brake hand lever to approximately a 45° angle. This is necessary for the required clearance to install the center console.

(20) Install the center console back in the vehicle.

(21) Install the wiring harness connector for the center console into the vehicle wiring harness (Fig. 136).

(22) Install the 2 screws attaching the front of the center console to the shifter (Fig. 134). Install the screw hole garnish cap and the PRNDL strip on the center console.

(23) Install the 3 screws attaching the rear of the center console to the console bracket (Fig. 135).

(24) Install the transmission range indicator (Fig. 133) in the center console.

(25) Install the shift knob on the shifter. Install and securely tighten the shift knob retaining screw.

(26) Fold the carpeting back into position on the rear floor of the vehicle.

(27) Install the 2 clips attaching the carpeting to the cross car beam.

(28) Install the 2 wiring harness routing clips on the cross car beam.

(29) Install the quarter trim panels. Refer to Group 23 Body in this service manual for the required installation procedure.



## REMOVAL AND INSTALLATION (Continued)

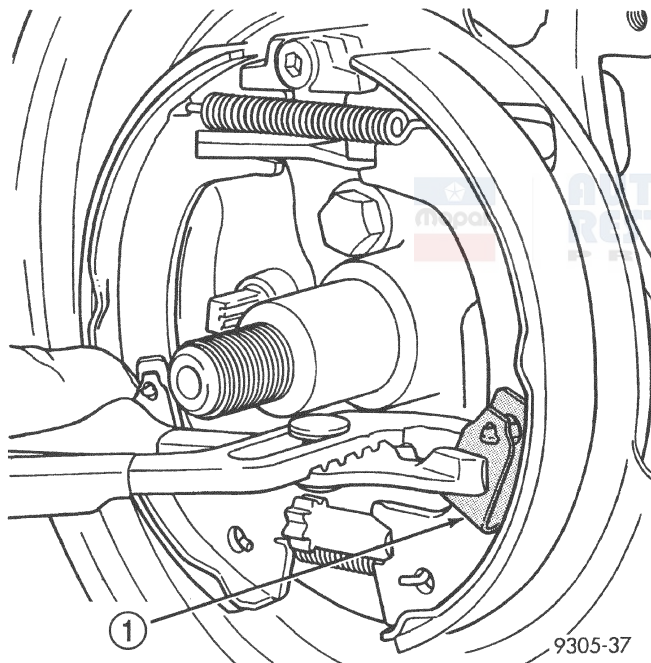
(30) Install both door sill plate scuff moldings, by snapping them onto the door sills.

(31) Install lower rear seat cushion. Be sure lower seat cushion is fully installed in retainers on floor pan of vehicle.

## PARKING BRAKE SHOES (WITH REAR DISC BRAKES)

### REMOVAL

- (1) Remove disc brake caliper from adapter and rotor (See Disc Brake Shoe Removal).
- (2) Remove rotor from hub/bearing.
- (3) Remove dust cap from hub/bearing.
- (4) Remove hub/bearing rear retaining nut and washer.
- (5) Remove hub/bearing from knuckle.
- (6) Remove hold down clip from rear park brake shoe (Fig. 150).



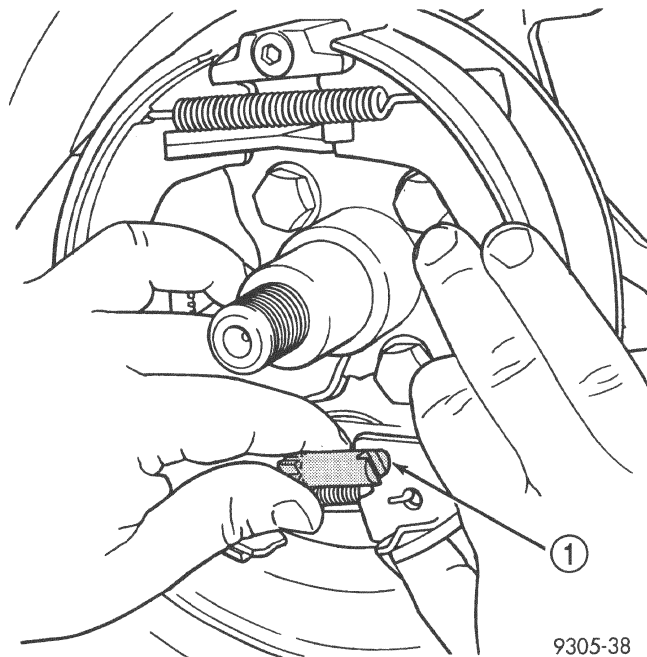
**Fig. 150 Rear Park Brake Shoe Hold-Down Clip**

1 - HOLD DOWN CLIP

(7) Turn park brake shoe adjuster wheel until adjuster is at its shortest length.

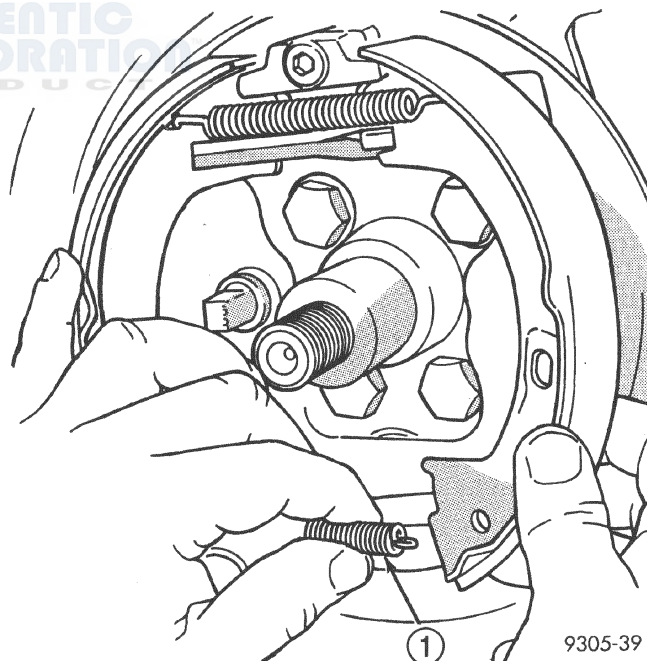
(8) Remove the park brake shoe adjuster from the park brake shoes (Fig. 151).

(9) Remove the lower return spring (Fig. 152) between the park brake shoes.



**Fig. 151 Park Brake Shoe Adjuster**

1 - ADJUSTER

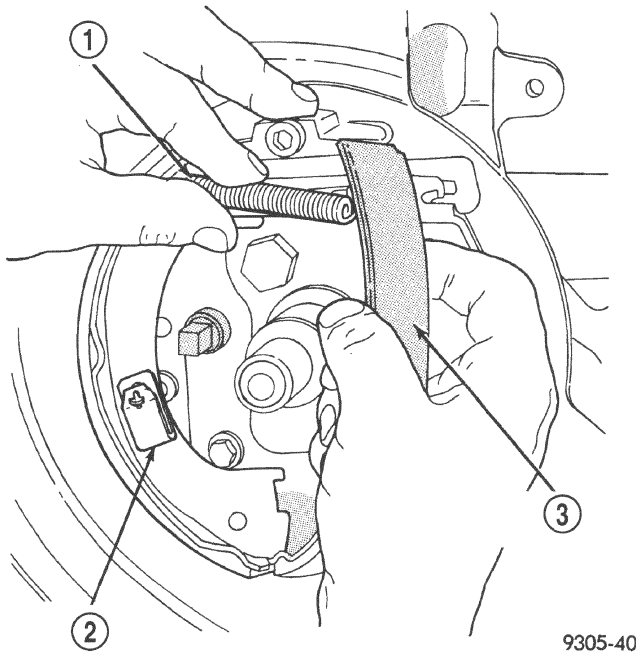


**Fig. 152 Brake Shoe Lower Return Spring**

1 - LOWER SPRING

**REMOVAL AND INSTALLATION (Continued)**

(10) Pull the rear park brake shoe away from the caliper adapter (Fig. 153). Remove the upper return spring (Fig. 153) from between the park brake shoes.



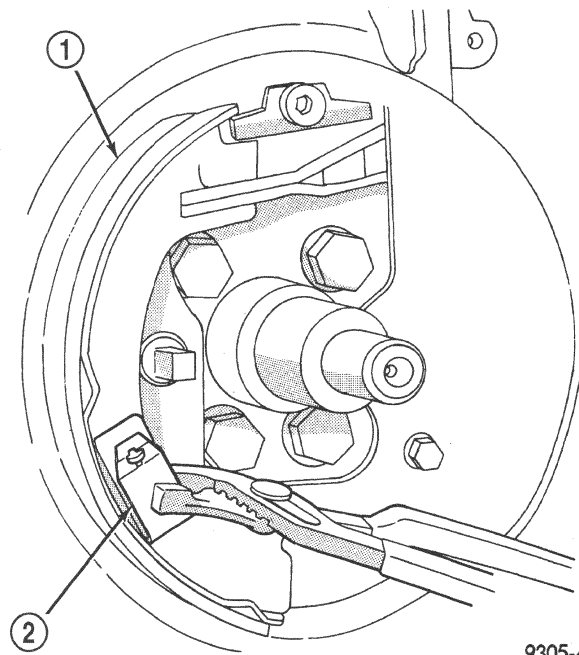
**Fig. 153 Brake Shoe and Upper Spring**

- 1 - UPPER SPRING
- 2 - HOLD DOWN CLIP
- 3 - REAR PARKING BRAKE SHOE

(11) Remove the hold-down clip from the front park brake shoe (Fig. 154). Then remove front park brake shoe.

**INSTALLATION**

- (1) Install front brake shoe and hold down clip (Fig. 154).
- (2) Install the rear park brake shoe and the park brake shoe upper return spring (Fig. 153).
- (3) Pull rear brake shoe over anchor block until properly located on adapter.
- (4) Install the park brake lower return spring (Fig. 152).
- (5) Install the adjuster between the park brake shoes. Adjuster must be installed with the star wheel toward the rear of the vehicle (Fig. 151).
- (6) Install hold down clip on rear park brake shoe (Fig. 150).
- (7) Adjust park brake shoes to an outside diameter of 171 mm (6.75 inch).
- (8) Install hub/bearing on knuckle.
- (9) Install **A NEW** hub/bearing retaining nut. Tighten the hub/ bearing retaining nut to a torque of 250 N·m (185 ft. lbs.).
- (10) Install dust cap on hub/bearing.
- (11) Install rotor.



**Fig. 154 Front Park Brake Shoe Hold Down Clip**

- 1 - FRONT BRAKE SHOE ASSEMBLY
- 2 - HOLD DOWN CLIP

(12) Install rear disc brake caliper on adapter (See Brake Shoe Removal).

(13) Install wheel and tire.

(14) Tighten wheel stud nuts to 129 N·m (95 ft.lbs.).

**BRAKE LAMP SWITCH****REMOVAL**

(1) Remove the brake lamp switch from its bracket (Fig. 155). The brake lamp switch is removed by depressing and holding the brake pedal while rotating brake lamp switch in a counter-clockwise direction approximately 30 degrees. Pull the switch rearward and remove it from its mounting bracket.

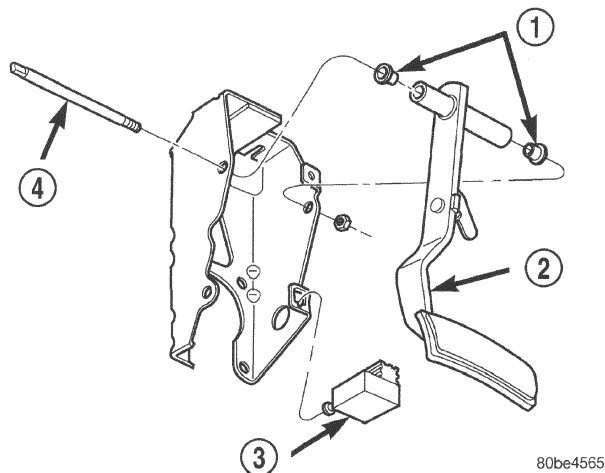
(2) Disconnect the wiring harness connector from the switch.

**INSTALLATION**

**NOTE:** Prior to installing brake lamp switch into the mounting bracket, the plunger must be moved to its fully extended position using the procedure in Step 1.

(1) Hold the brake lamp switch firmly in one hand. Using the other hand, pull outward on the plunger of the switch until it has ratcheted out to its fully extended position.

## REMOVAL AND INSTALLATION (Continued)



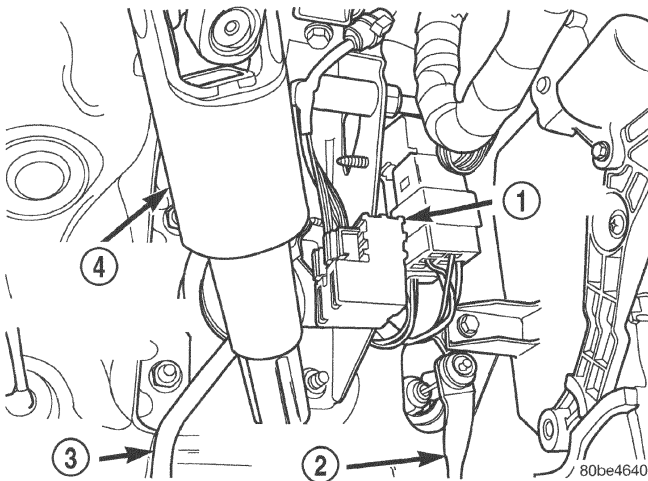
**Fig. 155 Switch And Bracket**

- 1 - BUSHINGS
- 2 - BRAKE PEDAL
- 3 - BRAKE LAMP SWITCH
- 4 - PIVOT SHAFT

(2) Connect the wiring harness connector to the brake lamp switch.

(3) Install the brake lamp switch in the brake pedal bracket (Fig. 155). Install it using the following procedure:

- Depress the brake pedal as far down as possible.
- Install the switch in its bracket by aligning the index tab on the switch with the slot in the mounting bracket.
- When the switch is fully seated in its bracket, rotate the switch clockwise approximately 30° to lock the switch into place. It should be aligned straight up and down (Fig. 156).



**Fig. 156 Brake Lamp Switch**

- 1 - SWITCH
- 2 - ACCELERATOR PEDAL
- 3 - BRAKE PEDAL
- 4 - STEERING COLUMN INTERMEDIATE SHAFT

**CAUTION:** Do not use excessive force when pulling back on the brake pedal to adjust the brake lamp switch. If too much force is used, the switch or striker can be damaged.

(4) Gently release/pull back on the brake pedal until the pedal stops moving. This will ratchet the switch plunger backward to the correct adjustment position.

(5) Check the brake lamps to verify they are operating properly and not staying on when the pedal is in the released position.

## DISASSEMBLY AND ASSEMBLY

### MASTER CYLINDER BRAKE FLUID RESERVOIR

**NOTE:** To replace the master cylinder brake fluid reservoir on this vehicle, it is not necessary to remove the master cylinder from the power brake booster.

### DISASSEMBLY

(1) Remove master cylinder from vehicle. Refer to REMOVAL AND INSTALLATION in this section.

(2) Using Mopar, Brake Parts Cleaner or an equivalent, thoroughly clean the master cylinder and brake fluid reservoir.

(3) Remove the brake fluid reservoir filler cap.

(4) Using a syringe or equivalent type tool, empty as much brake fluid as possible from the reservoir.

**CAUTION:** Do not pry fluid reservoir off master cylinder using a tool, damage to the reservoir or master cylinder can result.

(5) Remove brake fluid reservoir from master cylinder by rocking the reservoir from side to side while pulling upward on the fluid reservoir.

(6) Remove master cylinder housing to brake fluid reservoir sealing grommets (Fig. 157).

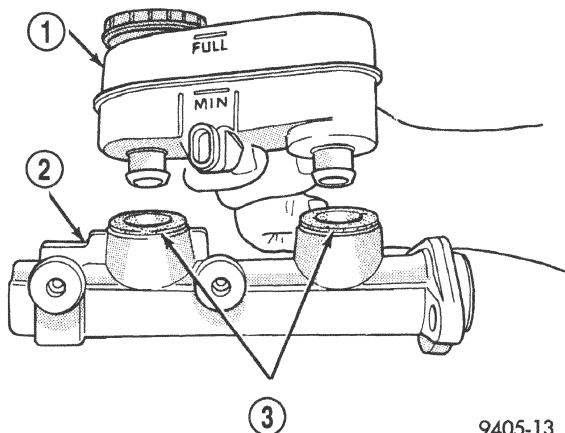
### ASSEMBLY

**CAUTION:** To ensure a leak proof seal when installing a fluid reservoir, never reuse the original fluid reservoir to master cylinder sealing grommets.

(1) Install new master cylinder housing to brake fluid reservoir sealing grommets (Fig. 157) in master cylinder housing.

(2) Lubricate reservoir mounting area with fresh clean brake fluid. Place reservoir in position over grommets. Seat reservoir into grommets using a rocking motion while firmly pressing down on fluid reservoir.



**DISASSEMBLY AND ASSEMBLY (Continued)**

9405-13

**Fig. 157 Removing Fluid Reservoir From Master Cylinder**

- 1 - FLUID RESERVOIR  
 2 - MASTER CYLINDER  
 3 - GROMMET

(3) Be sure reservoir is positioned properly.  
 (4) Make sure bottom of fluid reservoir touches top of both sealing grommets.

(5) Reinstall the master cylinder on the vehicle. Refer to REMOVAL AND INSTALLATION in this section.

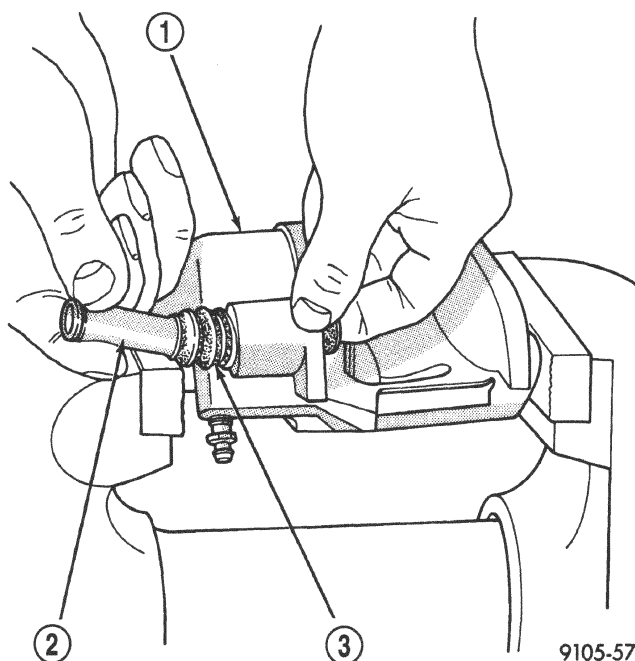
**DISC BRAKE CALIPER (FRONT AND REAR)**

Before disassembling the brake caliper, clean and inspect it. Refer to CLEANING AND INSPECTION in this section of this service manual group.

**CALIPER GUIDE PIN BUSHING****REMOVAL**

(1) With one hand, push the guide pin bushing sleeve towards the back of the caliper, and at the same time, pull the sleeve out the back of the caliper and bushing (Fig. 158).

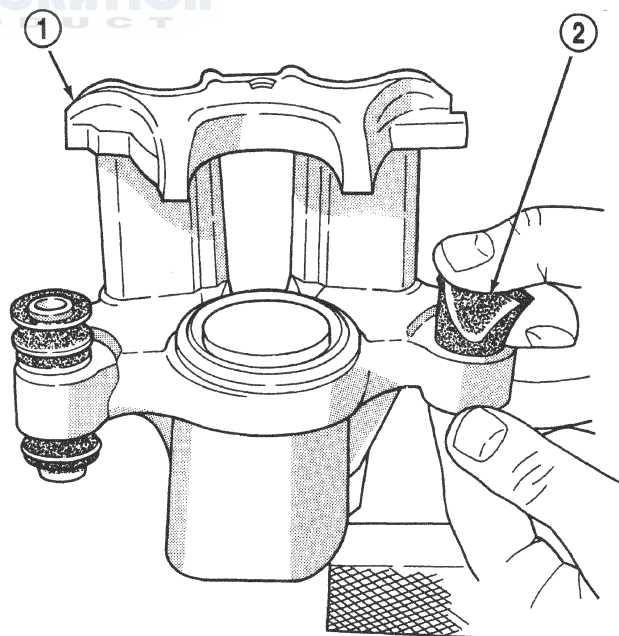
(2) Using your fingers, collapse one side of the rubber guide pin bushing. Pull the guide pin bushing out the other side of the brake caliper mounting boss (Fig. 159).



9105-57

**Fig. 158 Removing Sleeve From Bushing**

- 1 - CALIPER  
 2 - SLEEVE  
 3 - BUSHING



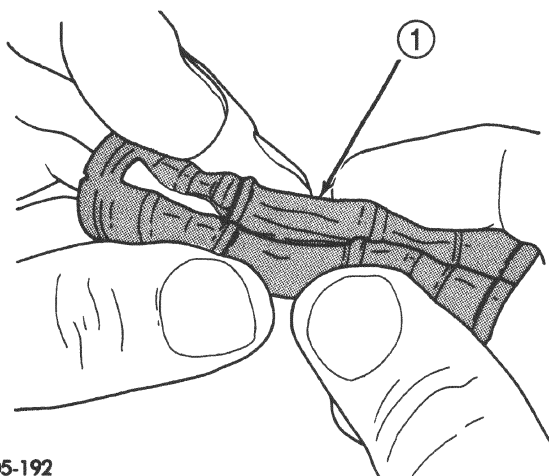
9105-58

**Fig. 159 Removing Bushing From Caliper**

- 1 - CALIPER  
 2 - BUSHING

**DISASSEMBLY AND ASSEMBLY (Continued)****INSTALLATION**

(1) Fold the guide pin bushing in half lengthwise at the solid middle section (Fig. 160).



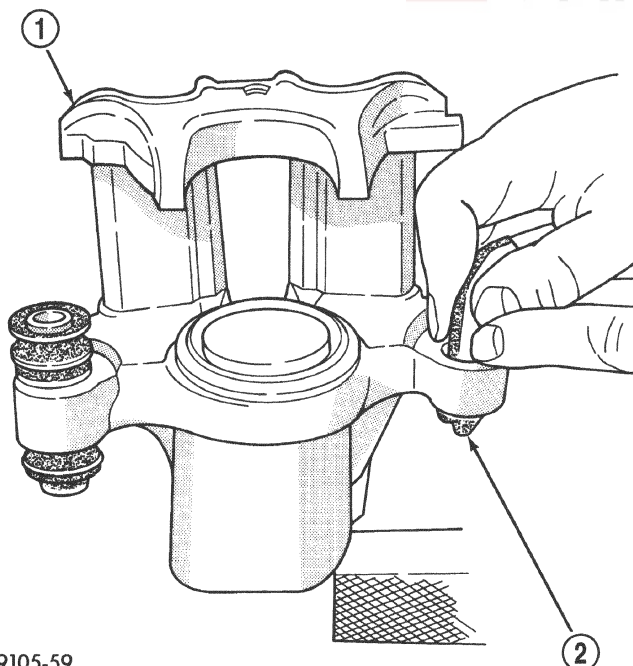
9205-192

**Fig. 160 Folded Caliper Guide Pin Bushing**

1 - CALIPER GUIDE PIN BUSHING

**NOTE:** To avoid damage to the bushing, do not use a sharp object to install the guide pin bushing.

(2) Insert the folded bushing into the caliper mounting boss using your fingers (Fig. 161).



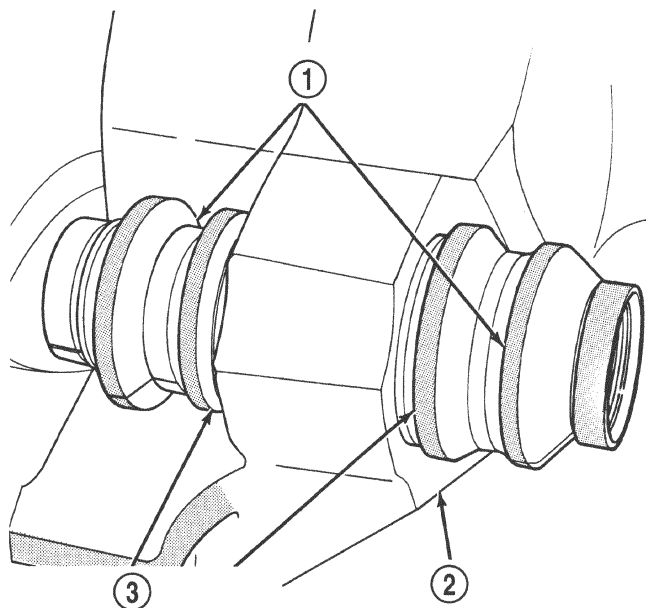
9105-59

**Fig. 161 Installing Caliper Guide Pin Bushing**

1 - CALIPER

2 - BUSHING

(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into the caliper housing. The bushing flanges should be seated evenly on both sides of the bushing hole (Fig. 162).



9205-193

**Fig. 162 Bushing Correctly Installed In Caliper**

1 - BUSHING

2 - CALIPER

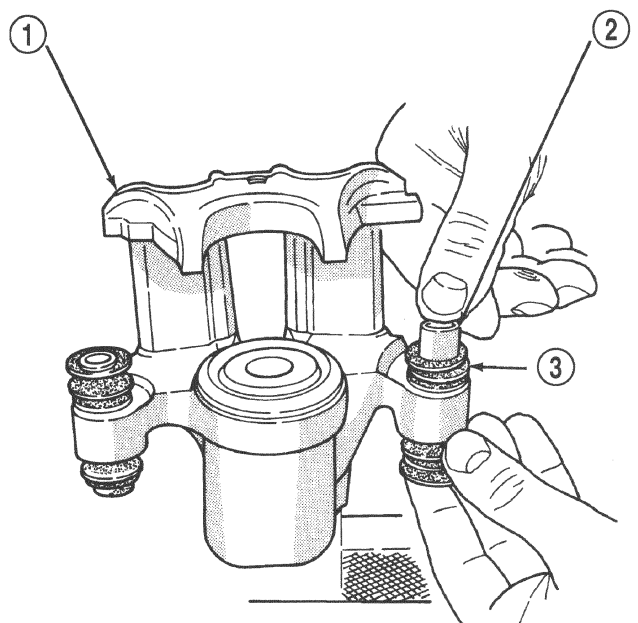
3 - BE SURE BOTH BUSHING FLANGES ARE FULLY SEATED AROUND CALIPER BUSHING BORES.

(4) Lubricate the inside surfaces of the bushing using Mopar Dielectric Grease or an equivalent.

(5) Install the guide pin sleeve into one end of bushing until the seal area of bushing is past the seal groove in the sleeve (Fig. 163).

(6) Holding the convoluted boot on the opposite end of the bushing, push the steel sleeve through the bushing until the bushing boot is fully seated into the seal groove on that end of sleeve (Fig. 163). Install the other end bushing boot into the groove on that end of the bushing sleeve.

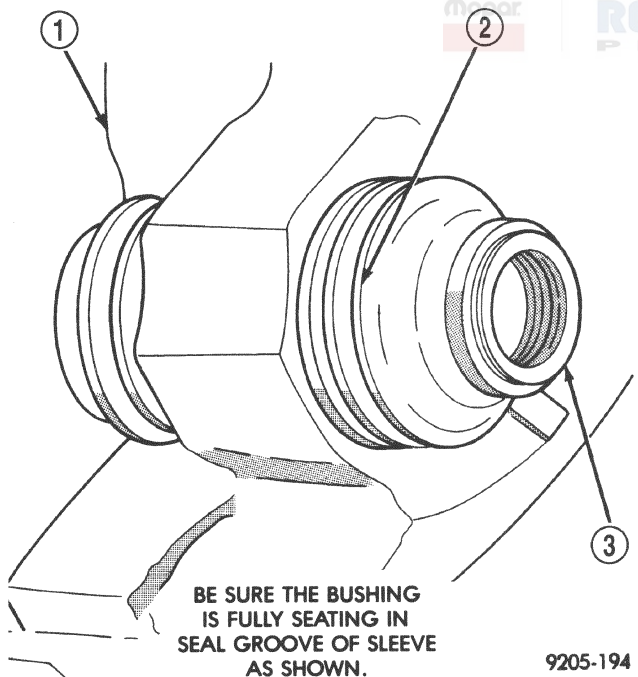
(7) Verify both ends of the bushing are seated in the sleeve grooves (Fig. 164). When the sleeve is seated properly into the bushing, the sleeve/bushing can be held between your fingers and easily slid back and forth without the bushing unseating from the sleeve groove.

**DISASSEMBLY AND ASSEMBLY (Continued)**

9105-60

**Fig. 163 Installing Sleeve In Bushing**

- 1 - CALIPER
- 2 - SLEEVE
- 3 - BUSHING



9205-194

**Fig. 164 Correctly Installed Guide Pin Sleeve And Bushing**

- 1 - CALIPER
- 2 - BUSHING
- 3 - SLEEVE

**CALIPER PISTON AND SEALS****CALIPER PISTON REMOVAL**

**WARNING:** UNDER NO CONDITION SHOULD HIGH PRESSURE AIR EVER BE USED TO REMOVE A PISTON FROM A CALIPER BORE. PERSONAL INJURY COULD RESULT FROM SUCH A PRACTICE.

**NOTE:** The safest way to remove the piston from the caliper bore is to use the hydraulic pressure of the vehicle's brake system.

(1) Following the removal procedure in DISC BRAKE SHOES found in this section, remove the caliper from the brake rotor and hang the assembly on a wire hook away from rotor and body of the vehicle so brake fluid cannot get on these components. Remove the brake shoes, and place a small piece of wood between the piston and caliper fingers.

(2) Carefully depress the brake pedal to hydraulically push piston out of its bore. Once completed, apply and hold down the brake pedal to any position beyond the first inch of pedal travel using a brake pedal holding tool. This will prevent the fluid in the master cylinder reservoir from completely draining out.

(3) Disconnect the brake fluid flex hose from the caliper assembly and remove it from the vehicle.

**CALIPER SEAL REMOVAL**

**CAUTION:** Do not use excessive force when clamping caliper in vise. Excessive vise pressure will cause bore distortion.

(1) To disassemble the caliper, mount it in a vise equipped with protective jaws.

(2) Remove the piston dust boot from the caliper and discard (Fig. 165).

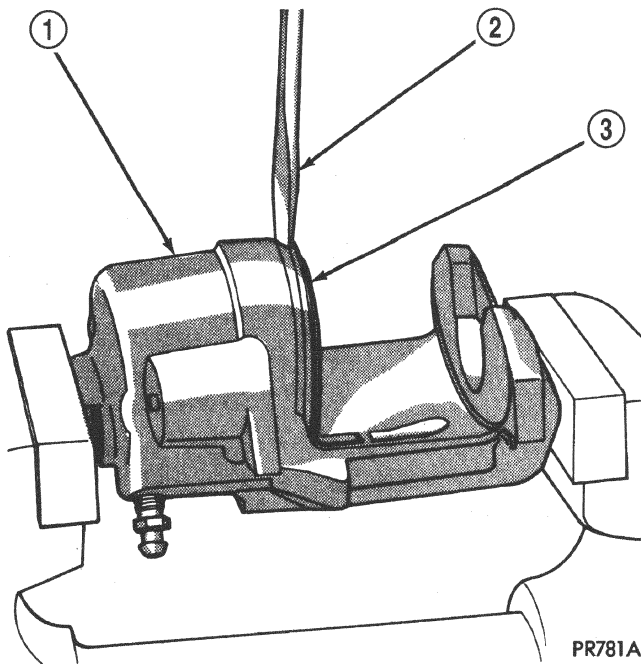
**NOTE:** Do not use a screw driver or other metal tool for seal removal. Using such tools can scratch the bore or leave burrs on the seal groove edges.

(3) Using a soft tool such as a plastic trim stick, work the piston seal out of its groove in caliper piston bore (Fig. 166). Discard the old seal.

(4) Clean the piston bore and drilled passage ways using alcohol or a suitable solvent. Wipe it dry using only a lint-free cloth.

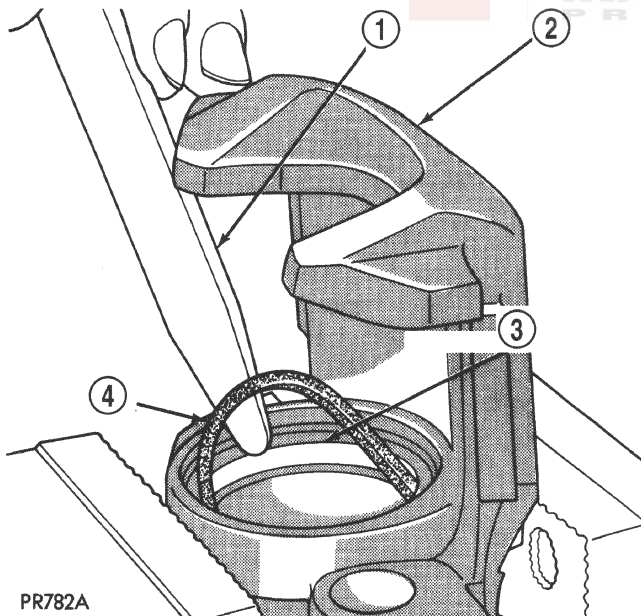


## DISASSEMBLY AND ASSEMBLY (Continued)



**Fig. 165 Removing Caliper/Piston Dust Boot**

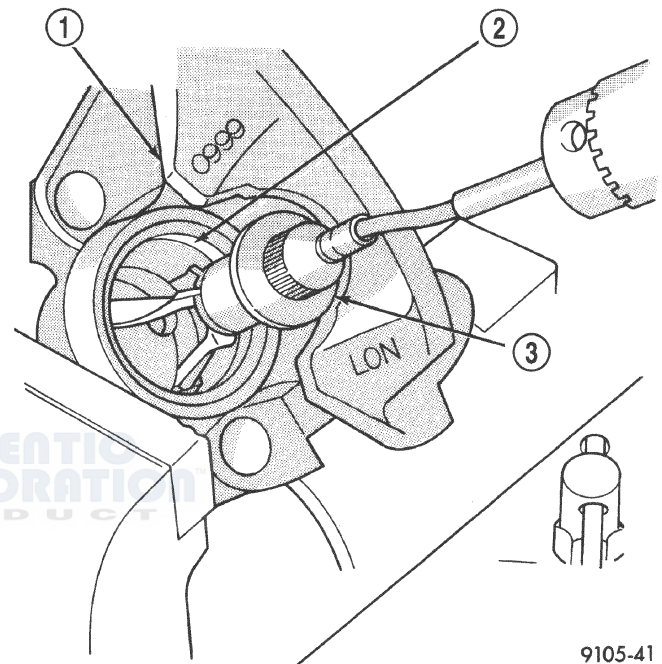
- 1 - CALIPER
- 2 - SCREWDRIVER
- 3 - BOOT



**Fig. 166 Removing Piston Seal**

- 1 - PLASTIC TRIM STICK
- 2 - CALIPER
- 3 - PISTON SEAL GROOVE
- 4 - PISTON SEAL

(5) Inspect the piston bore for scoring or pitting. Bores that show light scratches or corrosion can usually be cleared of the light scratches or corrosion using crocus cloth. Bores that have deep scratches or scoring should be honed. Use Caliper Hone, Special Tool C-4095, or the equivalent to hone the bore. Do not over-hone the bore. Do not increase the diameter of the bore more than 0.0254 mm (0.001 inch) (Fig. 167). If the bore does not clean up within this specification, a new caliper housing should be installed.



**Fig. 167 Honing Brake Caliper Piston Bore**

- 1 - CALIPER
- 2 - CALIPER BORE
- 3 - SPECIAL TOOL C-4095

**NOTE:** During the honing procedure, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with a stiff non-metallic rotary brush. Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper bore with fresh clean brake fluid; wipe it dry with a clean, lint free cloth and then clean it a second time.

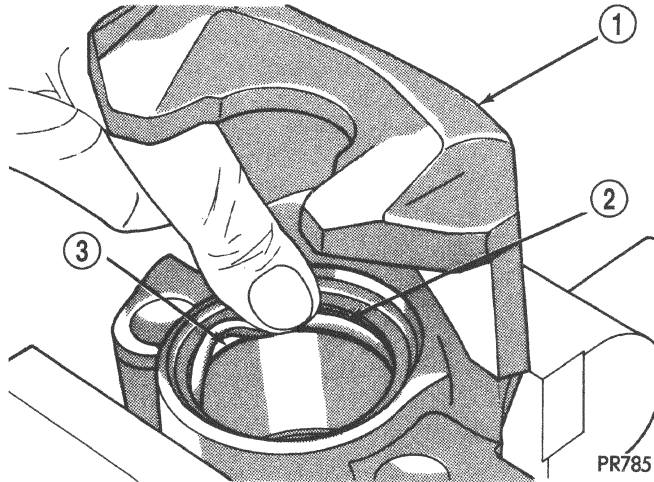
(6) Inspect the caliper piston for pitting, scratches, or any physical damage. Replace the piston if there is evidence of scratches, pitting or physical damage.

#### CALIPER SEAL AND PISTON INSTALLATION

**NOTE:** Never use an old piston seal.

**DISASSEMBLY AND ASSEMBLY (Continued)**

(1) Dip the new piston seal in clean brake fluid and install it in the groove of the caliper bore. The seal should be started at one area of the groove and gently worked around and into the groove (Fig. 168) using only your clean fingers to seat it.



**Fig. 168 Installing New Piston Seal**

- 1 - CALIPER
- 2 - PISTON SEAL
- 3 - SEAL GROOVE

(2) Coat the new piston boot with clean brake fluid leaving a generous amount inside the boot.

(3) Position the dust boot over the piston after coating it with brake fluid.

**CAUTION:** Force applied to the piston to seat it in the bore must be applied uniformly to avoid cocking and binding of the piston.

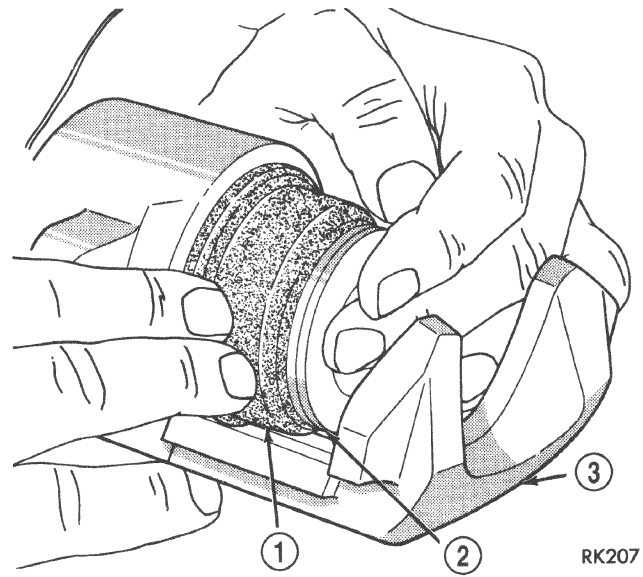
(4) Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 169).

(5) Position the dust boot into the counterbore of the caliper assembly piston bore.

(6) Using a hammer and Installer, Special Tool C-4689, and Handle, Special Tool C-4171, drive the boot into the counterbore of the caliper (Fig. 170).

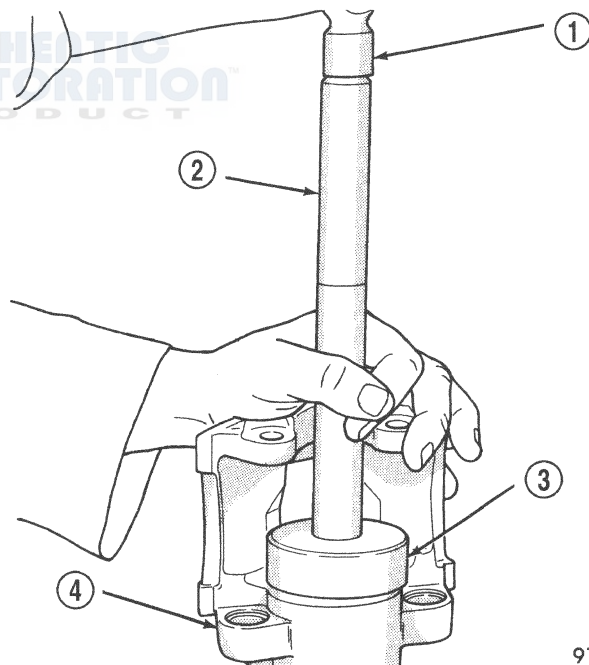
(7) Install the brake shoes.

(8) Reinstall the caliper on the vehicle and bleed the brakes as necessary. Follow the installation procedure found in DISC BRAKE CALIPER in the REMOVAL AND INSTALLATION section in this section of this service manual group.



**Fig. 169 Installing Piston Into Caliper Bore**

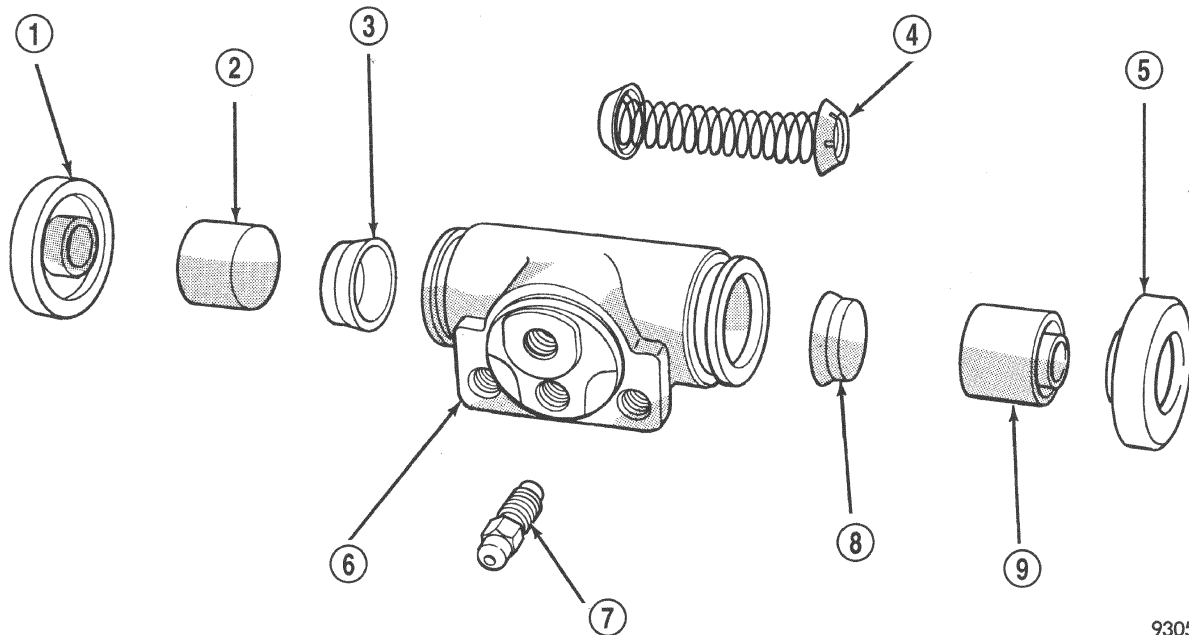
- 1 - BOOT
- 2 - PISTON
- 3 - CALIPER



**Fig. 170 Installing Dust Boot In Caliper Counterbore**

- 1 - HAMMER
- 2 - SPECIAL TOOL C-4171
- 3 - SPECIAL TOOL C-4689
- 4 - CALIPER

## DISASSEMBLY AND ASSEMBLY (Continued)



9305-172

Fig. 171 Rear Wheel Cylinder (Exploded View)

- 1 - PUSH-ON BOOT
- 2 - PISTON
- 3 - CUP
- 4 - CUP EXPANDERS AND SPRING
- 5 - PUSH-ON BOOT

- 6 - CYLINDER
- 7 - BLEEDER SCREW
- 8 - CUP
- 9 - PISTON

## DRUM BRAKE WHEEL CYLINDER (REAR)

## DISASSEMBLY

To disassemble the wheel cylinders, proceed as follows:

(1) Pry boots away from cylinders and remove (Fig. 171).

(2) Press **IN** on one piston to force out opposite piston, cup and spring (Fig. 171). Then using a soft tool such as a dowel rod, press out the cup and piston that remain in the wheel cylinder.

(3) Wash wheel cylinder, pistons, and spring (Fig. 171) in clean brake fluid or alcohol; **(DO NOT USE ANY PETROLEUM BASE SOLVENTS)** clean thoroughly and blow dry with compressed air. Inspect cylinder bore and piston for scoring and pitting. (Do not use a rag as lint from the rag will stick to bore surfaces.)

(4) Wheel cylinder bores and pistons that are badly scored or pitted should be replaced. Cylinder walls that have light scratches, or show signs of corrosion, can usually be cleaned with crocus cloth,

using a circular motion. Black stains on the cylinder walls are caused by piston cups and will not impair operation of cylinder.

## ASSEMBLY

Before assembling the pistons and new cups in the wheel cylinders, dip them in clean brake fluid. If the boots are deteriorated, cracked or do not fit tightly on the pistons or the cylinder casting, install new boots.

(1) Coat cylinder bore with clean brake fluid.

(2) Lightly coat the sealing lip and outer surfaces of the wheel cylinder cups with Mopar Protect-A-Cup Lubricant.

(3) Install expansion spring with cup expanders in cylinder. Install cups in each end of cylinder with open end of cups facing each other (Fig. 171).

(4) Install piston in each end of cylinder having the flat face of each piston contacting the flat face of each cup, already installed (Fig. 171).

(5) Install a boot over each end of cylinder (Fig. 171). **Be careful not to damage boot during installation.**



## CLEANING AND INSPECTION

### DISC BRAKES (FRONT)

#### BRAKE SHOE (PAD) LINING WEAR

If a visual inspection does not adequately determine the condition of the front disc brake shoe lining, a physical check will be necessary. To check the amount of brake shoe lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the front brake shoes. (See Brake Shoe Removal paragraph).

Combined front brake shoe thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 9.0 mm (3/8 inch) they should be replaced.

**Replace both brake shoes (inboard and outboard) on both front sides of the vehicle.**

If the front disc brake shoes do not require replacement, reinstall, the brake shoes making sure each brake shoe is returned to the original position on the vehicle it was removed from. (See Brake Pad Installation).

#### CALIPER INSPECTION

Check caliper for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of the piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper and install a new seal and boot, (and piston if scored). Refer to Caliper Disassembly And Re-Assembly Procedures in Disc Brake Caliper Service in this section of the service manual.

Check the caliper dust boot and caliper pin bushings to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

### DISC BRAKES (REAR)

#### BRAKE SHOE (PAD) LINING WEAR

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the rear disc brake shoes. Refer to Rear Disc Brake Shoe Removal in the Removal And Installation section in this group of the service manual for the required procedure.

The combined brake shoe and lining material thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 3.0 mm they should be replaced.

Replace **both** brake shoe assemblies (inboard and outboard). It is necessary that **both** rear wheel sets be replaced whenever brake shoe assemblies on either side are replaced.

If the brake shoe assemblies do not require replacement, reinstall, the assemblies making sure each brake shoe is returned to the original position. Refer to Rear Disc Brake Shoe Installation in the Removal And Installation section in this group of the service manual for the required procedure.

#### CALIPER INSPECTION

Check for brake fluid leaks in and around boot area and inboard lining, and for any ruptures, brittleness or damage to the piston dust boot. If the boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new seal and boot, and piston if scored. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

### DRUM BRAKES (REAR)

Clean metal portion of brake shoes. Check to see if shoes are bent.

Lining should show contact across entire width and from heel to toe, otherwise replace.

Shoes with lack of contact at toe or heel may be improperly ground.

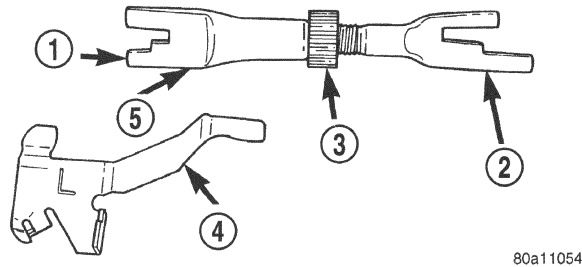
Clean and inspect the brake support plate and the automatic self adjusting mechanism.

Visually examine the adjuster assembly to ensure it is functioning correctly by checking for the following operation.

- Be sure the star wheel on the adjuster (Fig. 172) is free to rotate throughout its entire adjustment range.
- Ensure that the adjuster actuating lever is free to move on the brake shoe.
- Inspect the adjuster actuating spring (Fig. 172) for any signs of excessive wear or damage.
- Ensure that the teeth on the star wheel are not damaged (Fig. 172).
- Overall, examine the adjuster mechanism for excessive wear or damage and replace if necessary.

If the adjuster mechanism is re-useable, apply a light coat of Mopar Multi-Purpose Lubricant or equivalent, on the threads of the adjuster mechanism (Fig. 172).

## CLEANING AND INSPECTION (Continued)



**Fig. 172 Automatic Self Adjuster Mechanism And Actuating Lever**

- 1 - OUTBOARD FORWARD
- 2 - OUTBOARD REAR
- 3 - STAR WHEEL
- 4 - SELF ADJUSTER ACTUATING LEVER
- 5 - SELF ADJUSTER

If any return, hold down, or actuating springs have overheated or are damaged, replace them. Overheating indications are paint discoloration or distorted end coils.

## DRUM BRAKE WHEEL CYLINDER (REAR)

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Visually check the boots for cuts, tears, or heat cracks. If any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed.

If a wheel cylinder is leaking and the brake lining material is saturated with brake fluid, the brake shoes must be replaced.

## BRAKE TUBES AND HOSES

Flexible rubber hose is used at both front and rear brakes. Inspection of brake hoses should be performed whenever the brake system is serviced and every 7,500 miles or 12 months, whichever comes first (every engine oil change). Inspect hydraulic brake hoses for severe surface cracking, scuffing, worn spots or physical damage. If the fabric casing of the rubber hose becomes exposed due to cracks or abrasions in the rubber hose cover, the hose should be replaced immediately. Eventual deterioration of the hose can take place with possible burst failure. Faulty installation can cause twisting, resulting in wheel, tire, or chassis interference.

The steel brake tubing should be inspected periodically for evidence of corrosion, physical damage or contact with moving or hot components of the vehicle.

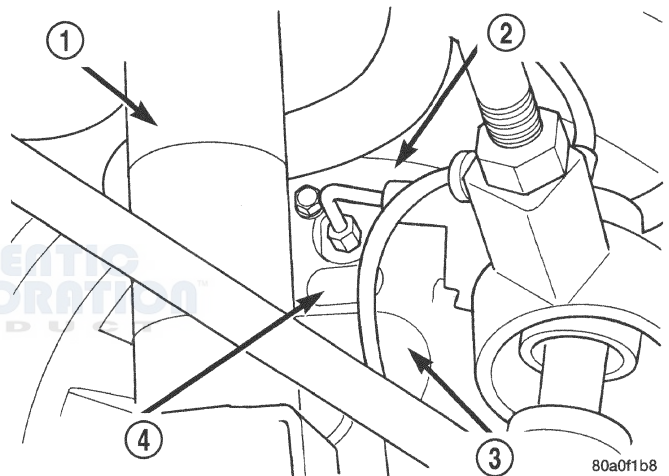
## ADJUSTMENTS

### DRUM BRAKE SHOES

**NOTE:** Normally, self adjusting drum brakes will not require manual brake shoe adjustment. Although in the event that the rear brake shoes are replaced it is advisable to make the initial adjustment manually to speed up the initial adjustment time.

(1) Raise vehicle using a frame contact type hoist or supported as required using jack stands. See moisting in the Lubrication And Maintenance group of this service manual for the required hoisting or jacking procedure to be used for this vehicle.

(2) Remove the rubber plug (Fig. 173) from the brake adjuster access hole in the brake support plate.



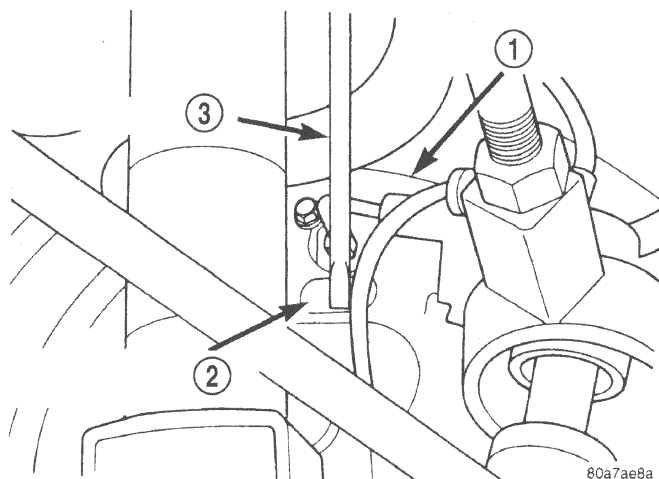
**Fig. 173 Brake Adjuster Access Hole Plug**

- 1 - SHOCK ABSORBER
- 2 - BRAKE SUPPORT PLATE
- 3 - KNUCKLE
- 4 - BRAKE ADJUSTER ACCESS HOLE PLUG

(3) **Be sure parking brake lever is fully released.**

(4) Insert a thin screwdriver through the adjuster access hole in the brake support plate (Fig. 174). Engage the tip of the screwdriver with the star wheel on the automatic adjuster. Move the handle of the screwdriver downward (toward the ground). Repeat the above procedure until drag is felt when rear wheel is rotated.

**CAUTION:** When performing the procedure in Step 5, care must be taken not to bend the adjuster actuating lever or distort the lever actuating spring.

**ADJUSTMENTS (Continued)****Fig. 174 Rear Brake Shoe Adjustment**

- 1 - BRAKE SUPPORT PLATE
- 2 - BRAKE ADJUSTER ACCESS HOSE
- 3 - SCREWDRIVER

(5) Insert a thin screwdriver or a piece of welding rod through the adjuster access hole. Carefully push the adjuster actuating lever out of engagement with the adjuster star wheel. While holding the adjuster actuating lever away from the star wheel insert a second screwdriver in access hole and engage it with the star wheel on the adjuster. Back off the adjuster star wheel until no drag is present when rotating the wheel.

(6) Repeat the above adjustment procedure at the other rear wheel.

(7) Apply and release the park brake lever one time after the rear brake shoes are adjusted. This will correctly adjust the tension of the park brake cables.

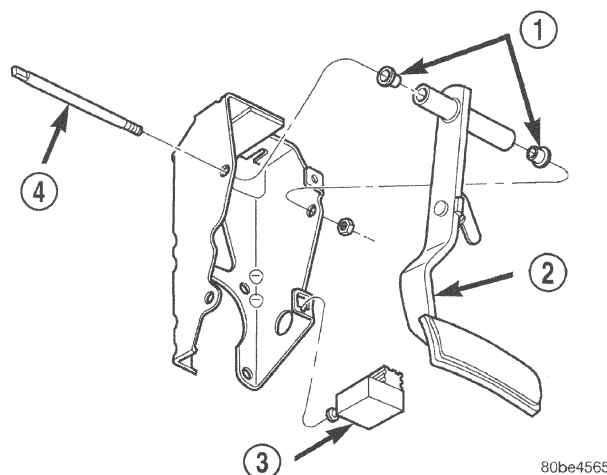
(8) Install the rubber plugs into the adjuster access holes in the brake support plates (Fig. 173).

**PARKING BRAKE**

Due to the automatic adjustment feature of the parking brake system used on this vehicle, manual adjustment of the parking brakes is not required. Proper adjustment of the parking brakes on this vehicle relies on the proper adjustment of the rear drum brake shoes. See Rear Brake Adjustment in the Service Adjustments Section in this group of the service manual for the required rear brake shoe adjustment procedure.

**BRAKE LAMP SWITCH**

(1) Remove the brake lamp switch from its bracket (Fig. 175). The brake lamp switch is removed by depressing and holding the brake pedal while rotating brake lamp switch in a counter-clockwise direction approximately 30 degrees. Pull the switch rearward and remove it from its mounting bracket.

**Fig. 175 Switch And Bracket**

- 1 - BUSHINGS
- 2 - BRAKE PEDAL
- 3 - BRAKE LAMP SWITCH
- 4 - PIVOT SHAFT

(2) Disconnect the wiring harness connector from the switch if necessary.

(3) Hold the brake lamp switch firmly in one hand. Using the other hand, pull outward on the plunger of the switch until it has ratcheted out to its fully extended position.

(4) Connect the wiring harness connector to the brake lamp switch if previously disconnected.

(5) Install the brake lamp switch in the brake pedal bracket (Fig. 175). Install it using the following procedure:

- Depress the brake pedal as far down as possible.
- Install the switch in its bracket by aligning the index tab on the switch with the slot in the mounting bracket.
- When the switch is fully seated in its bracket, rotate the switch clockwise approximately 30° to lock the switch into place. It should be aligned straight up and down (Fig. 176).



## ADJUSTMENTS (Continued)

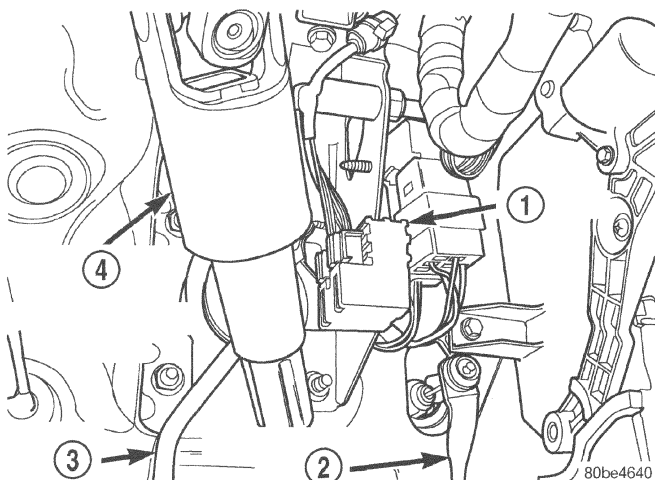


Fig. 176 Brake Lamp Switch

- 1 - SWITCH
- 2 - ACCELERATOR PEDAL
- 3 - BRAKE PEDAL
- 4 - STEERING COLUMN INTERMEDIATE SHAFT

**CAUTION:** Do not use excessive force when pulling back on the brake pedal to adjust the brake lamp switch. If too much force is used, the switch or striker can be damaged.

(6) Gently release/pull back on the brake pedal until the pedal stops moving. This will ratchet the switch plunger backward to the correct adjustment position.

(7) Check the brake lamps to verify they are operating properly and not staying on when the pedal is in the released position.

## SPECIFICATIONS

### BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.

**CAUTION:** Never use reclaimed brake fluid or fluid from an container which has been left open. An open container will absorb moisture from the air and contaminate the fluid.

**CAUTION:** Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.

## BRAKE ACTUATING SYSTEM

### ACTUATION:

Vacuum Operated Power Brakes . . . . . Standard  
Hydraulic System . . . . . Dual-Diagonally Split

### MASTER CYLINDER ASSEMBLY:

Supplier . . . . . Bosch  
Type . . . . . Center Valve Design  
Body Material . . . . . Anodized Aluminum  
Reservoir Material . . . . . Polypropelene

### MASTER CYLINDER BORE /

#### STROKE AND SPLIT:

ABS . . . . . 22.2 mm x 33.4 mm (.874 in. x 1.32 in.)  
Displacement Split . . . . . 50 / 50

### MASTER CYLINDER FLUID OUTLET PORTS:

ABS . . . . . Primary 7/16-24 Secondary 7/16-24  
Non ABS . . . Primary Inboard And Outboard 7/16-24  
Non ABS . . . Secondary Inboard And Outboard 3/8-23  
Outlet Fitting Type . . . Double Wall Inverted Flare

### ABS HYDRAULIC CONTROL UNIT:

Hydraulic Tube Fitting Type . . . Double Wall Inverted  
Flare

### BOOSTER:

Make/Type . . . . . Bosch Vacuum Assist  
Mounting Studs . . . . . M8 x 1.25  
Type . . . . . 205 mm Tandem  
Boost At 20 inches Of Manifold Vacuum . . 4690 All

### SCREW IN PROPORTIONING VALVE:

Material . . . . . Aluminum  
Function . . . . . Hydraulic Pressure Proportioning

### BRAKE PEDAL

Pedal Ratio . . . . . 3.32

## BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
<b>MASTER CYLINDER:</b>	
Booster Mounting Nut . . . . .	28 N·m (250 in. lbs.)
<b>BRAKE BOOSTER:</b>	
Dash Panel Mounting Nuts . . .	37 N·m (27 ft. lbs.)
<b>BRAKE PEDAL</b>	
Dash Panel Plenum Mounting Nut . . . . .	37 N·m (27 ft. lbs.)
Shaft To Brake Pedal Bracket Nut . . . . .	34 N·m (25 ft. lbs.)
<b>BRAKE TUBES:</b>	
Tube Nuts . . . . .	20 N·m (180 in. lbs.)
<b>BRAKE HOSE:</b>	
Caliper Banjo Bolt . . . . .	48 N·m (35 ft. lbs.)
Rear Intermediate Bracket . . .	11 N·m (100 in. lbs.)
Front And Rear Brackets	
To Frame Rails . . . . .	10 N·m (95 in. lbs.)
<b>DISC BRAKE CALIPER:</b>	
Guide Pin Bolts . . . . .	22 N·m (16 ft. lbs.)
Bleeder Screw . . . . .	20 N·m (15 ft. lbs.)

**SPECIFICATIONS (Continued)****DESCRIPTION****TORQUE****REAR WHEEL CYLINDER:**

To Support Plate Mounting Bolts . . . . . 13 N·m  
(115 in. lbs.)

Bleeder Screw . . . . . 10 N·m (90 in. lbs.)

**BRAKE SUPPORT PLATE:**

To Axle Mounting Bolts . . . . . 75 N·m (55 ft. lbs.)

**INTEGRATED CONTROL UNIT (HCU AND CAB):**

To Mounting Bracket Bolts . . . . . 28 N·m  
(250 in. lbs.)

Bracket To Crossmember

Mounting Bolts . . . . . 28 N·m (250 in. lbs.)

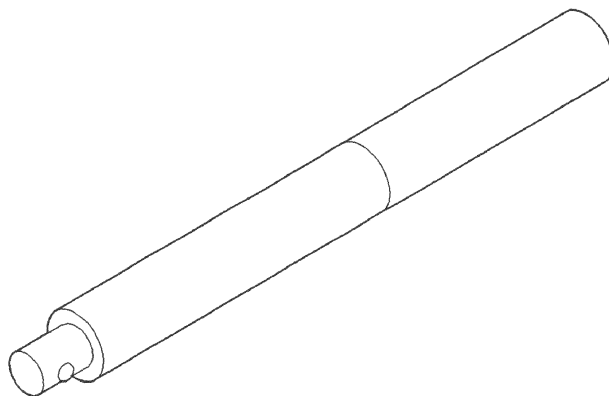
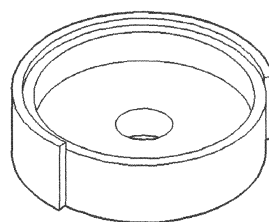
**PARKING BRAKE:**

Lever Mounting Nuts . . . . . 24 N·m (18 ft. lbs.)

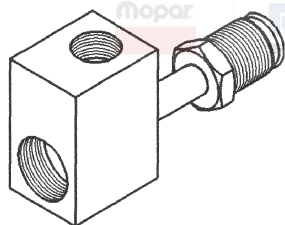
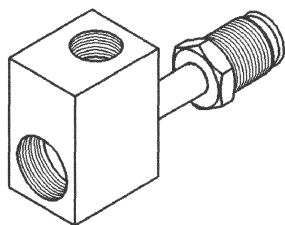
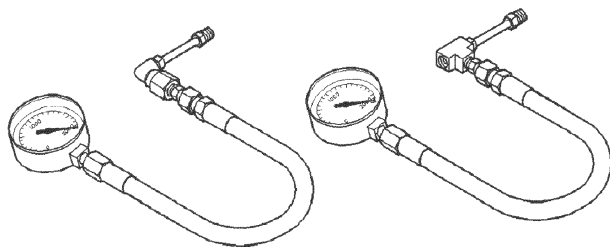
**REAR HUB AND BEARING:**

To Knuckle Retaining Nut . . . 250 N·m (185 ft. lbs.)

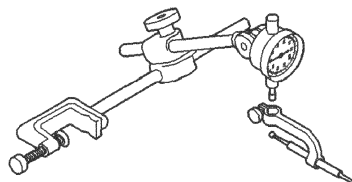
Stud Lug Nut . . . . 115–155 N·m (85–115 ft. lbs.)

**Handle, Universal C-4171**

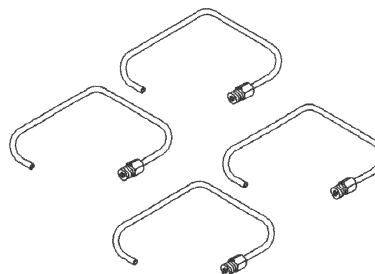
8011d811

**Installer, Dust Boot C-4689****Adapters, Brake Pressure Test 8187**

8011d474

**Gauge Set C-4007-A**

8011d42b

**Dial Indicator C-3339****Tubes, Master Cylinder Bleeding 6802**

# ANTILOCK BRAKE SYSTEM

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## DESCRIPTION AND OPERATION

### ANTILOCK BRAKE SYSTEM

#### DESCRIPTION

This section covers the physical and operational descriptions and the on-car service procedures for the Mark 20i Antilock Brake System and the Mark 20i Antilock Brake System with traction control.

The purpose of the antilock brake system (ABS) is to prevent wheel lockup under braking conditions on virtually any type of road surface. Antilock braking is desirable because a vehicle that is stopped without locking the wheels retains directional stability and some steering capability. This allows the driver to retain greater control of the vehicle during braking.

#### OPERATION

There are a few performance characteristics of the Mark 20i Antilock Brake System that may at first seem abnormal, but in fact are normal. These characteristics are described below.

#### NORMAL BRAKING

Under normal braking conditions, the ABS functions the same as a standard base brake system with a diagonally split master cylinder and conventional vacuum assist.

#### ABS BRAKING

ABS operation is available at all vehicle speeds above 3–5 mph. If a wheel locking tendency is detected during a brake application, the brake system enters the ABS mode. During ABS braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel circuit is designed with a set of electric solenoids to allow modulation and each wheel receives its own separate electrical signal. Wheel lockup may be perceived at the very end of an ABS stop and is considered normal.

During an ABS stop, the brakes hydraulic system is still diagonally split. However, the brake system pressure is further split into four control channels. During antilock operation of the vehicle's brake system, the front wheels are controlled independently and are on two separate control channels, and the rear wheels of the vehicle are controlled together.



**DESCRIPTION AND OPERATION (Continued)**

The system can build and release pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) at each wheel and received at the controller antilock brake (CAB).

**NOISE AND BRAKE PEDAL FEEL**

During ABS braking, some brake pedal movement may be felt. In addition, ABS braking will create ticking, popping, or groaning noises heard by the driver. This is normal and is due to pressurized fluid being transferred between the master cylinder and the brakes. If ABS operation occurs during hard braking, some pulsation may be felt in the vehicle body due to fore and aft movement of the suspension as brake pressures are modulated.

At the end of an ABS stop, ABS is turned off when the vehicle is slowed to a speed of 3–4 mph. There may be a slight brake pedal drop anytime that the ABS is deactivated, such as at the end of the stop when the vehicle speed is less than 3 mph or during an ABS stop where ABS is no longer required. These conditions exist when a vehicle is being stopped on a road surface with patches of ice, loose gravel, or sand on it. Also, stopping a vehicle on a bumpy road surface activates ABS because of the wheel hop caused by the bumps.

**TIRE NOISE AND MARKS**

Although the ABS system prevents complete wheel lockup, some wheel slip is desired in order to achieve optimum braking performance. Wheel slip is defined as follows: 0 percent slip means the wheel is rolling freely and 100 percent slip means the wheel is fully locked. During brake pressure modulation, wheel slip is allowed to reach up to 25–30 percent. This means that the wheel rolling velocity is 25–30 percent less than that of a free rolling wheel at a given vehicle speed. This slip may result in some tire chirping, depending on the road surface. This sound should not be interpreted as total wheel lockup.

Complete wheel lockup normally leaves black tire marks on dry pavement. The ABS will not leave dark black tire marks since the wheel never reaches a fully locked condition. However, tire marks may be noticeable as light patched marks.

**START-UP CYCLE**

When the ignition is turned on, a popping sound and a slight brake pedal movement may be noticed. The ABS warning lamp will also be on for up to 5 seconds after the ignition is turned on. When the vehicle is first driven off, a humming may be heard or felt by the driver at approximately 25–40 kph (15–25 mph). All of these conditions are a normal function of ABS as the system is performing a diagnosis check.

**PREMATURE ABS CYCLING**

Symptoms of premature ABS cycling include: clicking sounds from the solenoid valves; pump/motor running; and pulsations in the brake pedal. Premature ABS cycling can occur at any braking rate of the vehicle and on any type of road surface. Neither the red BRAKE warning lamp, nor the amber ABS warning lamp, illuminate and no fault codes are stored in the CAB.

Premature ABS cycling is a condition that needs to be correctly assessed when diagnosing problems with the antilock brake system. It may be necessary to use a DRB scan tool to detect and verify premature ABS cycling.

Check the following common causes when diagnosing premature ABS cycling: damaged tone wheels; incorrect tone wheels; damaged steering knuckle wheel speed sensor mounting bosses; loose wheel speed sensor mounting bolts; excessive tone wheel runout; or an excessively large tone wheel-to-wheel speed sensor air gap. Give special attention to these components when diagnosing a vehicle exhibiting premature ABS cycling.

After diagnosing the defective component, repair or replace it as required. When the component repair or replacement is completed, test drive the vehicle to verify that premature ABS cycling has been corrected.

**ANTILOCK BRAKE SYSTEM COMPONENTS**

The following is a detailed description of the antilock brake system components. For information on servicing base brake system components used in conjunction with these components, see the BASE BRAKE SYSTEM found at the beginning of this service manual group.

**MASTER CYLINDER****DESCRIPTION**

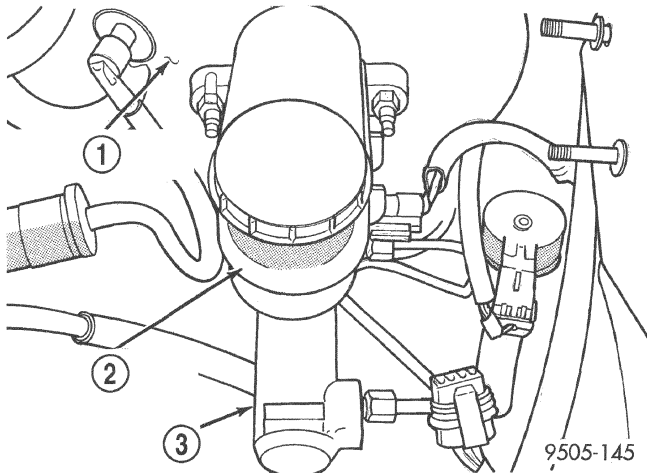
A vehicle equipped with ABS uses a different master cylinder (Fig. 1) than a vehicle that is not equipped with ABS. Vehicles equipped with ABS use a center port master cylinder while vehicles not equipped with ABS use a compensating port master cylinder.

The brake tubes from the primary and secondary outlet ports on the master cylinder go directly to the hydraulic control unit (HCU).

The power brake booster used on a vehicle equipped with ABS is the same as a vehicle not equipped with ABS.

Refer to the BASE BRAKE SYSTEM at the beginning of this service manual group for further information and procedures on master cylinders.

## DESCRIPTION AND OPERATION (Continued)



**Fig. 1 Master Cylinder**

- 1 - POWER BRAKE VACUUM BOOSTER
- 2 - MASTER CYLINDER FLUID RESERVOIR
- 3 - MASTER CYLINDER BODY

When the brake pedal is depressed, the master cylinder primary and secondary pistons apply brake pressure through the chassis brake tubes, ABS hydraulic control unit, and proportioning valves to each brake assembly. On ABS master cylinders, the primary outlet port supplies hydraulic pressure to the right front and left rear brakes. The secondary outlet port supplies hydraulic pressure to the left front and right rear brakes.

Refer to the BASE BRAKE SYSTEM at the beginning of this service manual group for further information.

### OPERATION

When the brake pedal is depressed, the master cylinder primary and secondary pistons apply brake pressure through the chassis brake tubes, ABS hydraulic control unit, and proportioning valves to each brake assembly. On ABS master cylinders, the primary outlet port supplies hydraulic pressure to the right front and left rear brakes. The secondary outlet port supplies hydraulic pressure to the left front and right rear brakes.

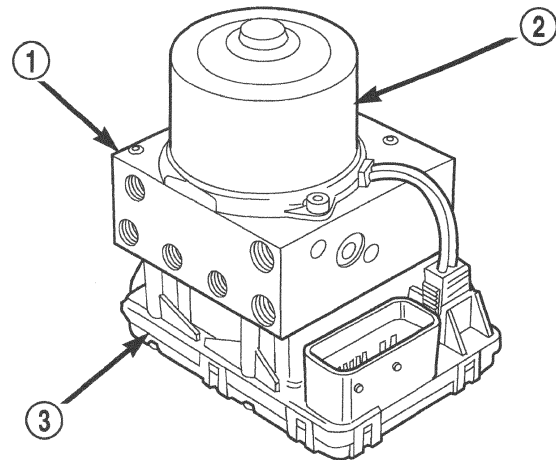
Refer to the BASE BRAKE SYSTEM at the beginning of this service manual group for further information.

## INTEGRATED CONTROL UNIT (ICU)

### DESCRIPTION

The hydraulic control unit (HCU) and the controller antilock brake (CAB) used with this antilock brake system are combined (integrated) into one unit, which is called the integrated control unit (ICU) (Fig. 2). The ICU is located on the passenger's side of

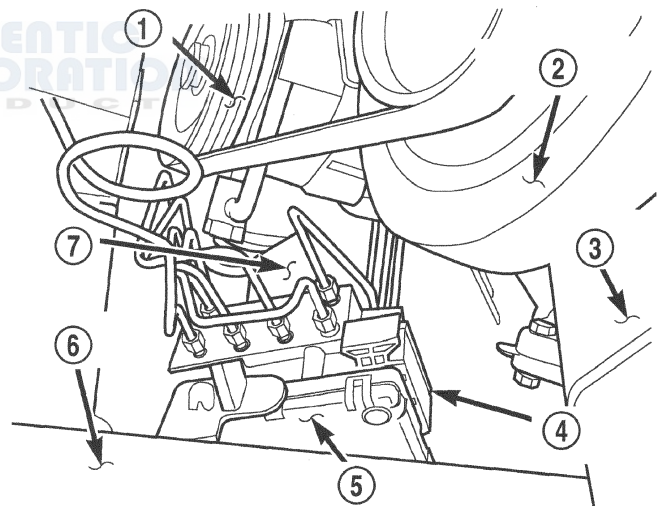
the vehicle, and is mounted on top of the front suspension crossmember (Fig. 3). It can be accessed from under the vehicle.



80ae846a

**Fig. 2 Integrated Control Unit (ICU)**

- 1 - HCU
- 2 - PUMP/MOTOR
- 3 - CAB



**NOTE: SHOWN FROM UNDER VEHICLE**

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**Fig. 3 ICU Mounting Location**

- 1 - POWER STEERING PULLEY
- 2 - ENGINE CRANKSHAFT PULLEY
- 3 - ENGINE OIL PAN
- 4 - CAB CONNECTOR
- 5 - CONTROLLER ANTILOCK BRAKE (CAB)
- 6 - RIGHT HALF SHAFT
- 7 - PUMP MOTOR

Two different HCU's and CAB's are used on this vehicle depending on whether or not the vehicle is equipped with traction control. The HCU on a vehicle



**DESCRIPTION AND OPERATION (Continued)**

equipped with ABS and traction control has a valve block housing that is approximately 1 inch longer on the low pressure fluid accumulators side than a HCU on a vehicle that is equipped with only ABS.

The ABS-only ICU consists of the following components: the CAB, eight (build/decay) solenoid valves (four inlet valves and four outlet valves), valve block, fluid accumulators, a pump, and an electric motor.

The ABS-with traction control ICU consists of the following components: the CAB, eight (build/decay) solenoid valves (four inlet valves and four outlet valves), two hydraulic shuttle valves, two ASR valves, valve block, fluid accumulators, a pump, and an electric pump/motor. On vehicles with traction control, the ICU contains 10 solenoid valves. The two ASR valves and solenoids are used to isolate the brake system during traction control operation.

The replaceable components of the ICU are the HCU and the CAB. No attempt should be made to service any individual components of the HCU or CAB.

**OPERATION**

For information on the operation of the ICU, refer to the individual components:

- CONTROLLER ANTILOCK BRAKE (CAB)
- HYDRAULIC CONTROL UNIT (HCU)

For information on the ICU's hydraulic circuits, refer to **HYDRAULIC CIRCUITS AND VALVE OPERATION** which can be found elsewhere in this section.

**CONTROLLER ANTILOCK BRAKE (CAB)****DESCRIPTION**

The controller antilock brake (CAB) is a microprocessor-based device which monitors the ABS system during normal braking and controls it when the vehicle is in an ABS stop. The CAB is mounted to the bottom of the HCU (Fig. 2). The CAB uses a 25-way electrical connector on the vehicle wiring harness. The power source for the CAB is through the ignition switch in the RUN or ON position. The CAB is on the CCD bus.

**OPERATION**

The primary functions of the CAB are to:

- (1) monitor the antilock brake system for proper operation.
- (2) detect wheel locking or wheel slipping tendencies by monitoring the speed of all four wheels of the vehicle.
- (3) control fluid modulation to the wheel brakes while the system is in an ABS mode or the traction control system is activated.

- (4) store diagnostic information.

- (5) provide communication to the DRB scan tool while in diagnostic mode.

The CAB constantly monitors the antilock brake system for proper operation. If the CAB detects a fault, it will turn on the amber ABS warning lamp and disable the antilock braking system. The normal base braking system will remain operational.

The CAB continuously monitors the speed of each wheel through the signals generated by the wheel speed sensors to determine if any wheel is beginning to lock. When a wheel locking tendency is detected, the CAB actuates its solenoids. This actuation opens and closes the valves in the HCU thereby modulating brake fluid pressure in the hydraulic circuits. The CAB continues to control pressure in individual hydraulic circuits until a locking tendency is no longer present.

The CAB contains a self-diagnostic program that monitors the antilock brake system for system faults. When a fault is detected, the amber ABS warning lamp is turned on and the fault diagnostic trouble code (DTC) is then stored in a diagnostic program memory. These DTC's will remain in the CAB memory even after the ignition has been turned off. The DTC's can be read and cleared from the CAB memory by a technician using the DRB scan tool. If not cleared with a DRB scan tool, the fault occurrence and DTC will be automatically cleared from the CAB memory after the identical fault has not been seen during the next 3,500 miles.

**CONTROLLER ANTILOCK BRAKE INPUTS**

- wheel speed sensors (four)
- stop lamp switch
- ignition switch
- system voltage
- ground
- traction control switch (if equipped)
- diagnostic communication (CCD)

**CONTROLLER ANTILOCK BRAKE OUTPUTS**

- amber ABS warning lamp actuation
- instrument cluster (MIC)
- traction control lamps (if equipped)
- diagnostic communication (CCD)

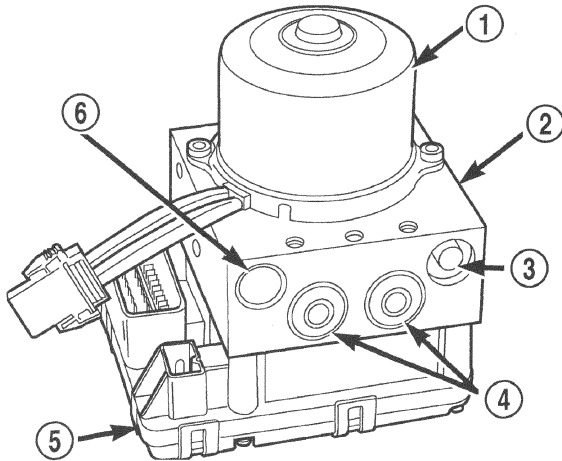
**HYDRAULIC CONTROL UNIT (HCU)****DESCRIPTION**

The hydraulic control unit (HCU) is mounted to the CAB as part of the ICU (Fig. 4). The ICU is located on the passenger's side of the vehicle, and is mounted on top of the front suspension crossmember (Fig. 3). It can be accessed from under the vehicle.



## DESCRIPTION AND OPERATION (Continued)

The HCU controls the flow of brake fluid to the brakes using a series of valves and accumulators. A pump/motor is mounted on the HCU to supply build pressure to the brakes during an ABS stop.



**Fig. 4 Integrated Control Unit (ICU)**

- 1 - PUMP MOTOR
- 2 - HYDRAULIC CONTROL UNIT (HCU)
- 3 - NOISE DAMPENING CHAMBER
- 4 - LOW PRESSURE FLUID ACCUMULATORS
- 5 - CAB
- 6 - LIP SEAL SAVER

The HCU on a vehicle equipped with ABS and traction control has a valve block housing that is approximately 1 inch longer on the low pressure fluid accumulators side than a HCU on a vehicle that is equipped with only ABS.

For more information, see INTEGRATED CONTROL UNIT in this section.

### OPERATION

The operation of the HCU can be found in HYDRAULIC CIRCUITS AND VALVE OPERATION which can be found elsewhere in this section. The following topics explain how the different components within the HCU operate.

### VALVES AND SOLENOIDS

The valve block contains four inlet valves and four outlet valves. The inlet valves are spring-loaded in the open position and the outlet valves are spring-loaded in the closed position during normal braking. The fluid is allowed to flow from the master cylinder to the wheel brakes.

During an ABS stop, these valves cycle to maintain the proper slip ratio for each wheel. The inlet valve closes preventing further pressure increase and the outlet valve opens to provide a path from the wheel brake to the HCU accumulators and pump/motor. This releases (decays) pressure from the wheel brake,

thus releasing the wheel from excessive slippage. Once the wheel is no longer slipping, the outlet valve is closed and the inlet valve is opened to reapply (build) pressure.

On vehicles with traction control, there is an extra set of valves and solenoids. The ASR valves, mounted in the HCU valve block, are normally in the open position and close only when the traction control is applied.

These isolator valves are used to isolate the rear (non-driving) wheels of the vehicle from the hydraulic pressure that the HCU pump/motor is sending to the front (driving) wheels when traction control is being applied. The rear brakes need to be isolated from the master cylinder when traction control is being applied so the rear wheels do not drag. For more information, see TRACTION CONTROL SYSTEM in this section.

### BRAKE FLUID ACCUMULATORS

There are two fluid accumulators in the HCU—one for the primary hydraulic circuit and one for the secondary hydraulic circuit (Fig. 4). Each hydraulic circuit uses a 5 cc accumulator.

The fluid accumulators temporarily store brake fluid that is removed from the wheel brakes during an ABS cycle. This stored fluid is used by the pump/motor to provide build pressure for the brake hydraulic system. When the antilock stop is complete, the accumulators are drained by the pump/motor.

On ABS-only vehicles, there is a mini-accumulator on the secondary hydraulic circuit that protects the master cylinder seals during an ABS stop, and there is a noise dampening chamber on the primary circuit.

On ABS with traction control vehicles, there are two noise dampening chambers in the HCU.

### PUMP/MOTOR

There are two pump assemblies in the HCU—one for the primary hydraulic circuit and one for the secondary hydraulic circuit. Both pumps are driven by a common electric motor (Fig. 4). This DC-type motor is integral to the HCU and is controlled by the CAB.

The pump/motor provides the extra amount of brake fluid needed during antilock braking. Brake fluid is released to the accumulators when the outlet valve is opened during an antilock stop. The pump mechanism consists of two opposing pistons operated by an eccentric camshaft. In operation, one piston draws fluid from the accumulators, and the opposing piston pumps fluid to the master cylinder circuits. When the antilock stop is complete, the pump/motor drains the accumulators.

The CAB may turn on the pump/motor when an antilock stop is detected. The pump/motor continues to run during the antilock stop and is turned off after

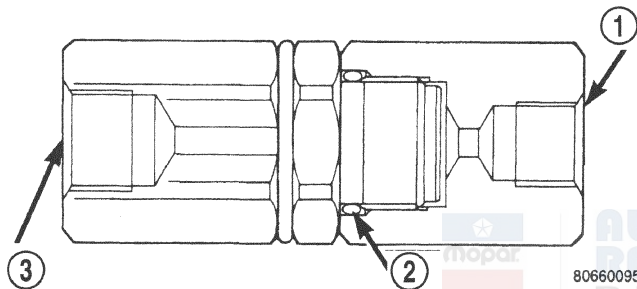
**DESCRIPTION AND OPERATION (Continued)**

the stop is complete. Under some conditions, the pump/motor runs to drain the accumulators during the next drive-off.

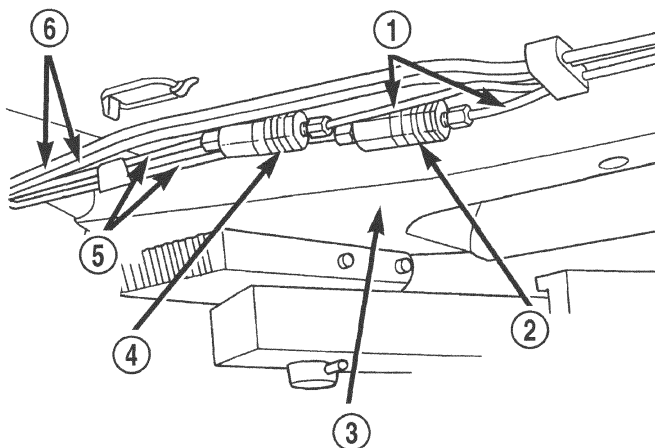
The pump/motor is not a serviceable item; if it requires replacement, the HCU must be replaced.

**PROPORTIONING VALVE****DESCRIPTION**

There are two proportioning valves (Fig. 5) used in the antilock brake system. One proportioning valve is located in the chassis brake tube leading to each rear wheel brake hydraulic circuit. They can be found to the inside of the right frame rail (Fig. 6). The proportioning valve can be identified by its bar code label and stamp. Be sure a replacement proportioning valve has the same stamp as the proportioning valve being replaced.

**Fig. 5 Proportioning Valve**

- 1 - FROM MASTER CYLINDER
- 2 - O. RING SEAL
- 3 - TO REAR BRAKES

**Fig. 6 Proportioning Valve Location In Vehicle**

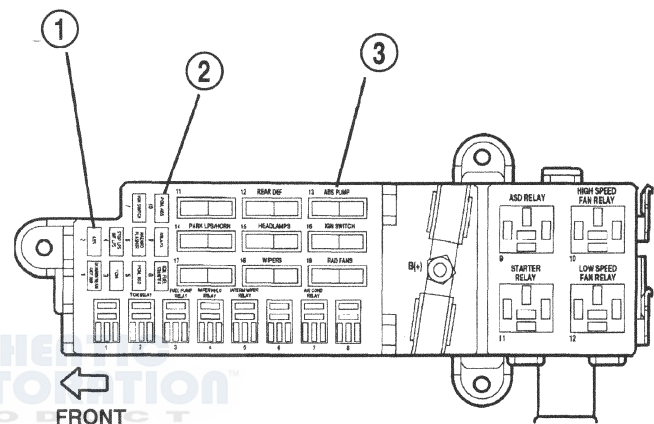
- 1 - CHASSIS BRAKE TUBES
- 2 - RIGHT REAR BRAKE PROPORTIONING VALVE
- 3 - RIGHT FRAME RAIL
- 4 - LEFT REAR BRAKE PROPORTIONING VALVE
- 5 - CHASSIS BRAKE TUBES
- 6 - FUEL TUBES

**OPERATION**

The ABS proportioning valves function the same as the proportioning valves in the base brake system.

**ABS FUSES****DESCRIPTION**

The ABS fuses and the ABS pump/motor fuse are located in the power distribution center (PDC). Refer to the sticker on the inside of the PDC cover for the location of these fuses or use the following figure (Fig. 7). The PDC is located on the driver's side of the engine compartment between the radiator and the brake master cylinder.

**Fig. 7 Fuse Location**

- 1 - ABS FUSE
- 2 - PCM, ABS FUSE
- 3 - ABS PUMP FUSE

**ABS RELAYS (SOLID STATE)****DESCRIPTION**

Two internal relays are used to control the antilock brake system. The two relays are the pump/motor relay and the system relay. The pump/motor relay and the system relay are located in the CAB. If either the pump/motor relay or the system relay is diagnosed as not functioning properly, the CAB must be replaced. Refer to INTEGRATED CONTROL UNIT in the DISASSEMBLY AND ASSEMBLY section in this section of this service manual group for the procedure to remove the CAB from the HCU.



## DESCRIPTION AND OPERATION (Continued)

### AMBER ABS WARNING LAMP

#### DESCRIPTION

The amber ABS warning lamp is located on the left side of the instrument cluster. The purpose of the warning lamp is discussed in detail below.

#### OPERATION

When the ignition key is turned to the ON position, the amber ABS warning lamp is lit until the CAB completes its self-tests and turns off the lamp (approximately 4 seconds). The amber ABS warning lamp will illuminate when the CAB detects a condition that results in the shutdown of ABS function or when the mechanical instrument cluster (MIC) does not receive messages from the CAB. The CAB turns on the amber ABS warning lamp by grounding the circuit.

Under most conditions, when the amber ABS warning lamp is on, only the ABS function of the brake system is affected; the base brake system and the ability to stop the vehicle are not affected.

### WHEEL SPEED SENSOR (WSS) AND TONE WHEEL

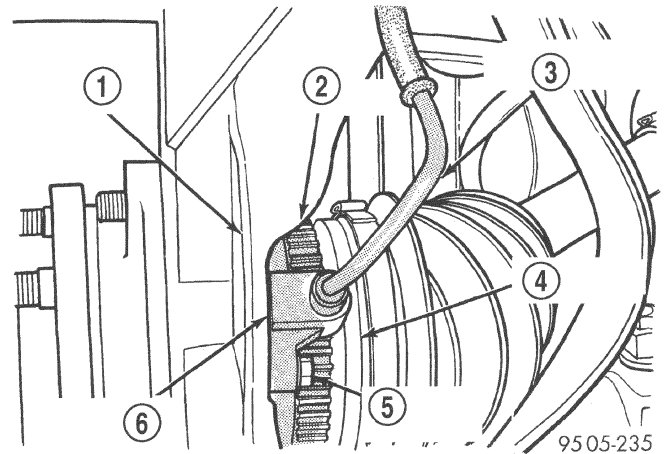
#### DESCRIPTION

One wheel speed sensor (WSS) and one tone wheel are located at each front (Fig. 8) and rear (Fig. 9) (Fig. 10) wheel. Each front wheel speed sensor is attached to a boss in the steering knuckle. The front tone wheel is part of the outboard constant velocity joint. The rear wheel speed sensor on rear drum brake applications is mounted to the brake support plate. The rear wheel speed sensor on rear disc brake applications is mounted to the rear disc brake adapter. The rear tone wheel is an integral part of the rear wheel hub and bearing.

#### OPERATION

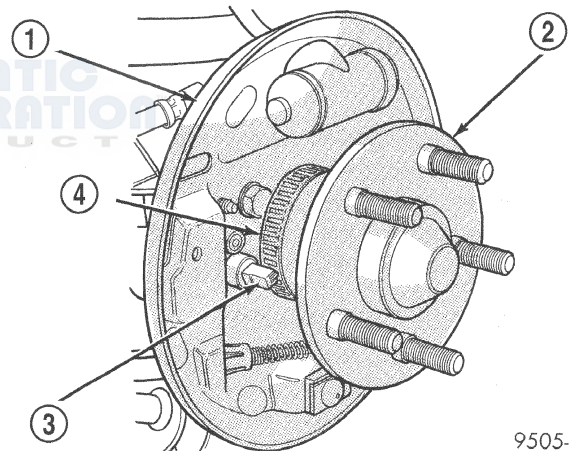
The wheel speed sensor sends a small AC signal to the CAB. This signal is generated by magnetic induction created when a toothed sensor ring (tone wheel) (Fig. 8) (Fig. 9) (Fig. 10) passes the stationary magnetic wheel speed sensor. The CAB converts the AC signal into a digital signal. If a wheel locking tendency is detected by the CAB, it will then modulate hydraulic pressure via the HCU to prevent the wheel(s) from locking.

Correct ABS operation is dependent on accurate wheel speed signals. The vehicle's tires and wheels all must be the same size and type to generate accurate signals. Variations in tire and wheel size can produce inaccurate wheel speed signals.



**Fig. 8 Front Wheel Speed Sensor**

- 1 - STEERING KNUCKLE
- 2 - TONE WHEEL
- 3 - WHEEL SPEED SENSOR CABLE
- 4 - DRIVESHAFT
- 5 - ATTACHING BOLT
- 6 - WHEEL SPEED SENSOR

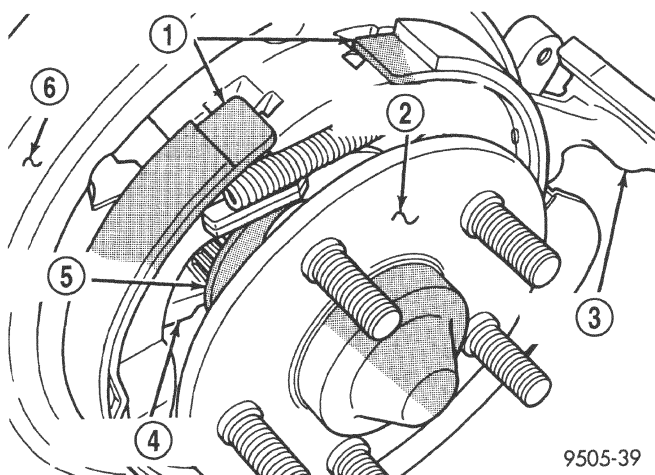


**Fig. 9 Rear Wheel Speed Sensor With Drum Brakes**

- 1 - BRAKE SUPPORT PLATE
- 2 - HUB/BEARING ASSEMBLY
- 3 - WHEEL SPEED SENSOR
- 4 - TONE WHEEL

Improper speed sensor-to-tone wheel clearance can cause erratic speed sensor signals. The speed sensor air gap is not adjustable, but should be checked when applicable. Wheel speed sensor-to-tone wheel clearance specifications can be found in the SPECIFICATIONS section in this section of this service manual group.



**DESCRIPTION AND OPERATION (Continued)****Fig. 10 Rear Wheel Speed Sensor With Disc Brakes**

- 1 - PARKING BRAKE SHOES
- 2 - HUB/BEARING ASSEMBLY
- 3 - DISC BRAKE ADAPTER
- 4 - WHEEL SPEED SENSOR
- 5 - TONE WHEEL
- 6 - DISC SHIELD

**TRACTION CONTROL SYSTEM****DESCRIPTION**

Traction control reduces wheel slip and maintains traction at the driving wheels at speeds below 80 kph (50 mph) when road surfaces are slippery. The traction control system reduces wheel slip by braking the wheel that is losing traction.

**TRACTION CONTROL FUNCTION LAMP**

The traction control function lamp illuminates during a traction control cycle, displaying TRAC on the instrument panel signifying the ABS is in traction control mode.

**OPERATION**

The CAB monitors wheel speed. During acceleration, if the CAB detects front (drive) wheel slip and the brakes are not applied, the CAB enters traction control mode. Traction control operation proceeds in the following order:

(1) Close the normally open traction control (TC) ASR valves.

(2) Start the pump/motor and supply volume and pressure to the front (drive) hydraulic circuit. (The

pump/motor runs continuously during traction control operation.)

(3) Open and close the build and decay solenoid valves to maintain minimum wheel slip and maximum traction.

The cycling of the build and decay valves during traction control is similar to that during antilock braking, except the valves work to control wheel spin by applying the brakes, whereas the ABS function is to control wheel skid by releasing the brakes.

The traction control system is enabled at each ignition cycle. It may be turned off by depressing the traction control switch button.

**TRACTION CONTROL FUNCTION LAMP**

The traction control function lamp illuminates during a traction control cycle, displaying TRAC on the instrument panel.

The traction control function lamp (TRAC OFF) illuminates immediately upon depressing the TRAC OFF button. Pressing this button again, or turning off and restarting the vehicle will enable the traction control system.

If the CAB calculates that the brake temperatures are high, the traction control system becomes inoperative until a cool-down period has elapsed. During this "thermo-protection mode," the traction control function lamp illuminates TRAC OFF; note that no trouble code is registered.

**HYDRAULIC SHUTTLE VALVES**

Two pressure relief shuttle valves allow pressure and volume to return to the master cylinder reservoir when not consumed by the build and decay valves. These valves are necessary because the pump/motor supplies more volume than the system requires.

If the brakes are applied at anytime during a traction control cycle, the brake lamp switch triggers the control module to switch off traction control.

**HYDRAULIC CIRCUITS AND VALVE OPERATION**

The hydraulic fluid control valves control the flow of pressurized brake fluid to the wheel brakes during the different modes of ABS braking. The following paragraphs explain how this works. For purposes of explanation only, it is assumed that only the right front wheel is experiencing antilock braking; the following diagrams show only the right front wheel in an antilock braking operation.

## DESCRIPTION AND OPERATION (Continued)

MK20 ABS  
(ONE CIRCUIT, ONE WHEEL ONLY)  
NORMAL BRAKING

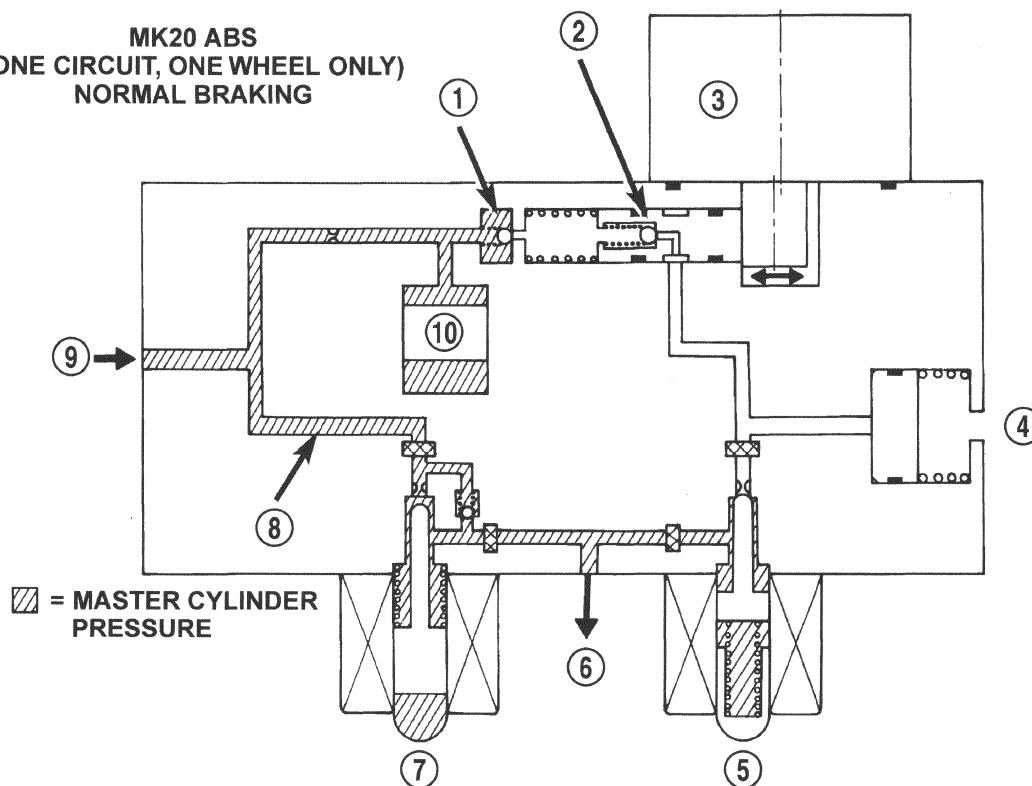


Fig. 11 Normal Braking Hydraulic Circuit

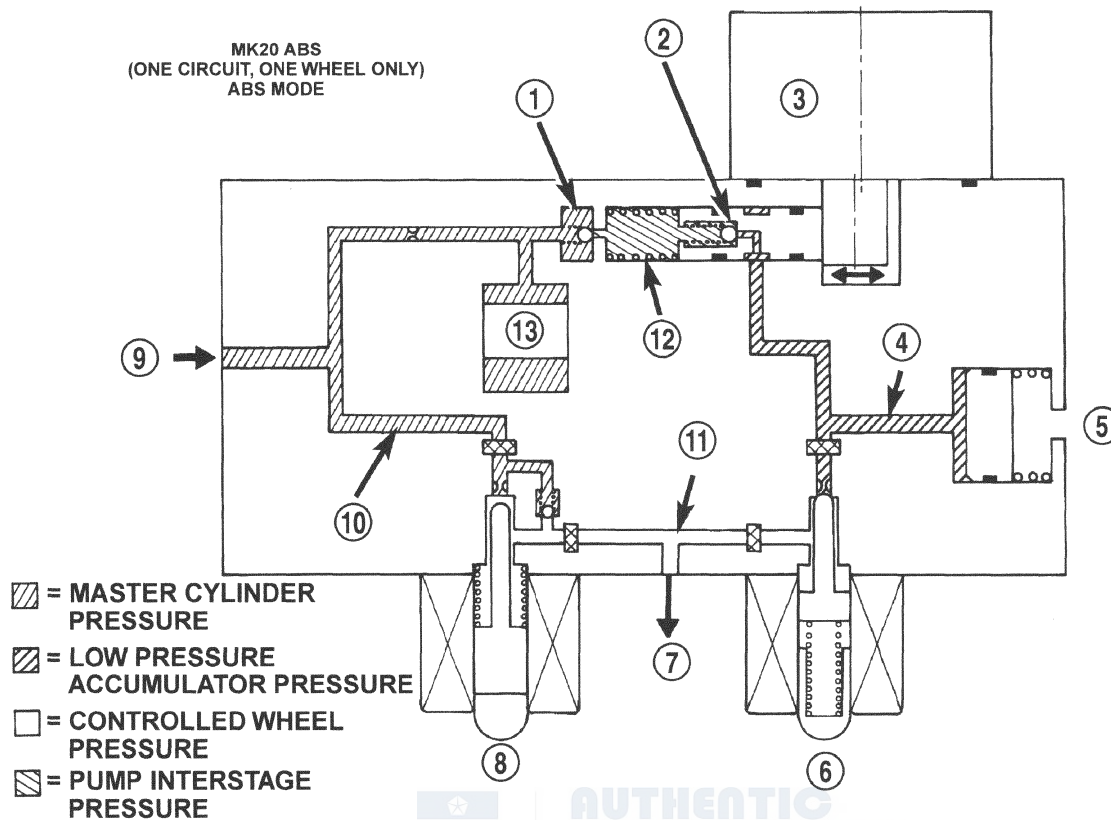
- |                                 |                               |
|---------------------------------|-------------------------------|
| 1 - OUTLET VALVE                | 6 - TO RIGHT FRONT WHEEL      |
| 2 - PUMP PISTON                 | 7 - NORMALLY OPEN VALVE (OFF) |
| 3 - PUMP MOTOR (OFF)            | 8 - MASTER CYLINDER PRESSURE  |
| 4 - LOW PRESSURE ACCUMULATOR    | 9 - FROM MASTER CYLINDER      |
| 5 - NORMALLY CLOSED VALVE (OFF) | 10 - NOISE DAMPER CHAMBER     |

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## NORMAL BRAKING HYDRAULIC CIRCUIT AND SOLENOID VALVE FUNCTION

The hydraulic diagram (Fig. 11) shows the vehicle in the normal braking mode of the base brake hydraulic system. The diagram shows no wheel spin or slip occurring relative to the speed of the vehicle. The driver is applying the brake pedal which builds pressure in the brake hydraulic system to engage the brakes and stop the vehicle.

## DESCRIPTION AND OPERATION (Continued)



**Fig. 12 ABS Without Traction Control - ABS Mode Hydraulic Circuit**

- |  |                                      |
|--|--------------------------------------|
| 1 - OUTLET VALVE                       | 8 - NORMALLY OPEN VALVE (MODULATING) |
| 2 - PUMP PISTON                        | 9 - FROM MASTER CYLINDER             |
| 3 - PUMP MOTOR (ON)                    | 10 - MASTER CYLINDER PRESSURE        |
| 4 - LOW PRESSURE ACCUMULATOR PRESSURE  | 11 - CONTROLLED WHEEL PRESSURE       |
| 5 - LOW PRESSURE ACCUMULATOR           | 12 - PUMP INTERSTAGE PRESSURE        |
| 6 - NORMALLY CLOSED VALVE (MODULATING) | 13 - NOISE DAMPER CHAMBER            |
| 7 - TO RIGHT FRONT WHEEL               |                                      |

### ABS HYDRAULIC CIRCUIT AND SOLENOID VALVE FUNCTION (ABS WITHOUT TRACTION CONTROL)

The hydraulic diagram (Fig. 12) shows the vehicle in the ABS braking mode. The diagram shows one wheel is slipping because the driver is attempting to stop the vehicle at a faster rate than is allowed by the surface on which the tires are riding.

- The normally open and normally closed valves modulate (build/decay) the brake hydraulic pressure as required.

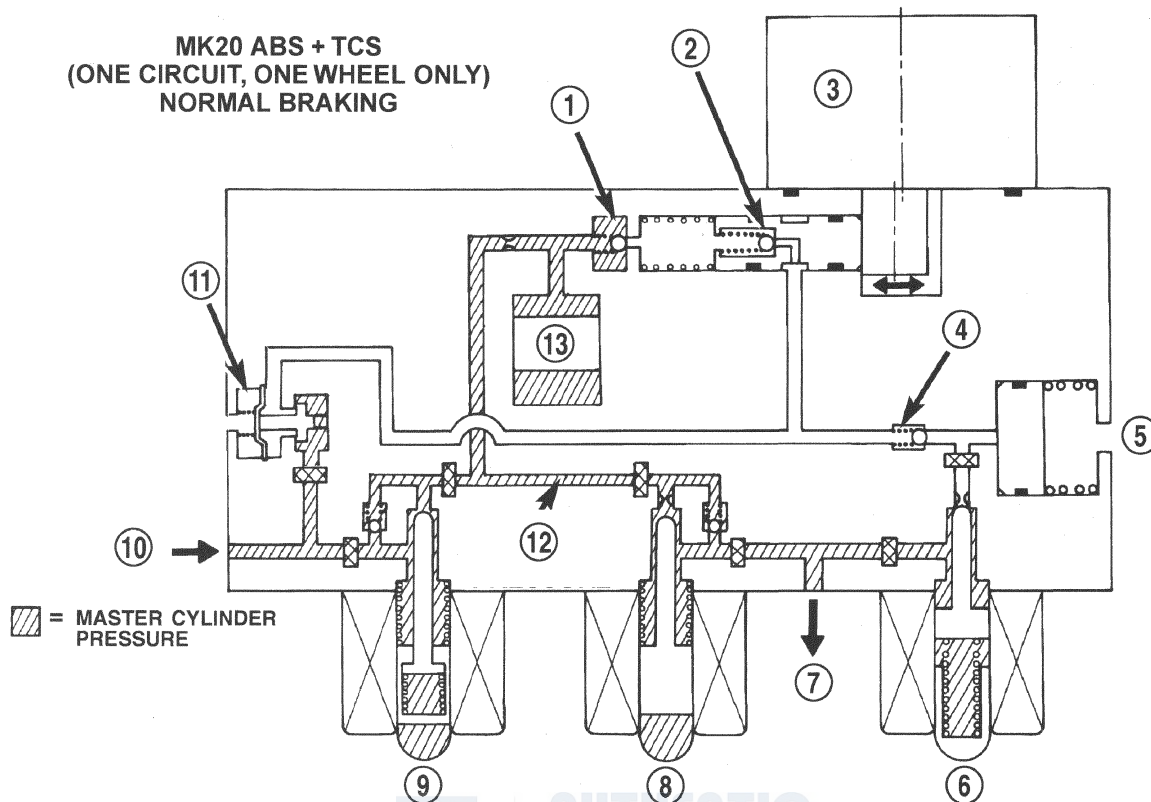
- The pump/motor is switched on so that the brake fluid from the low pressure accumulators is returned to the master cylinder circuits.

- The brake fluid is routed to either the master cylinder or the wheel brake depending on the position of the normally open valve.

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## DESCRIPTION AND OPERATION (Continued)



**Fig. 13 ABS With Traction Control - Normal Braking Hydraulic Circuit**

- |                                 |                                   |
|---------------------------------|-----------------------------------|
| 1 - OUTLET VALVE                | 8 - NORMALLY OPEN VALVE (OFF)     |
| 2 - PUMP PISTON                 | 9 - NORMALLY OPEN ASR VALVE (OFF) |
| 3 - PUMP MOTOR (OFF)            | 10 - FROM MASTER CYLINDER         |
| 4 - SUCTION VALVE               | 11 - HYDRAULIC SHUTTLE VALVE      |
| 5 - LOW PRESSURE ACCUMULATOR    | 12 - MASTER CYLINDER PRESSURE     |
| 6 - NORMALLY CLOSED VALVE (OFF) | 13 - NOISE DAMPER CHAMBER         |
| 7 - TO RIGHT FRONT WHEEL        |                                   |

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### NORMAL BRAKING HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)

The hydraulic diagram (Fig. 13) shows a vehicle with traction control in the normal braking mode. The diagram shows no wheel spin or slip occurring

relative to the speed of the vehicle. The driver is applying the brake pedal which builds pressure in the brake hydraulic system to engage the brakes and stop the vehicle. the hydraulic shuttle valve closes with every brake pedal application so pressure is not created at the inlet to the pump/motor.

**DESCRIPTION AND OPERATION (Continued)****ABS BRAKING HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)**

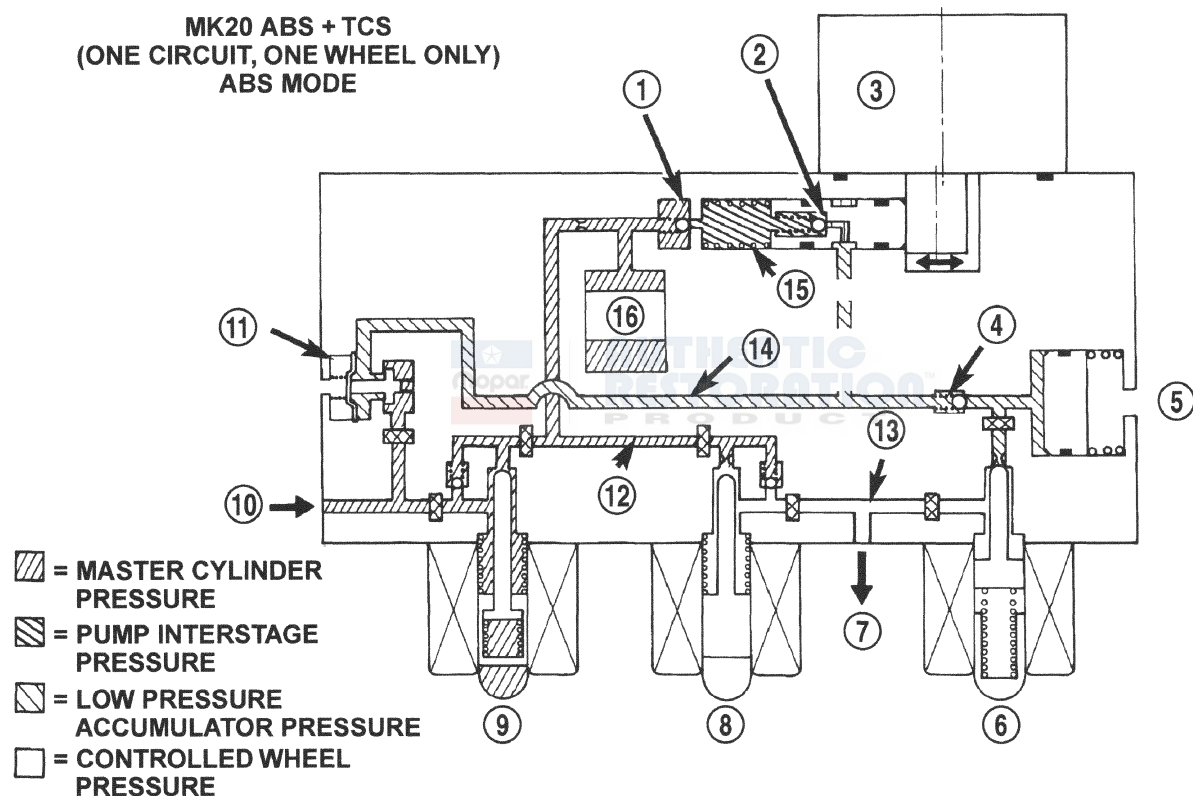
The hydraulic diagram (Fig. 14) shows the vehicle in the ABS braking mode. The diagram shows one wheel is slipping because the driver is attempting to stop the vehicle at a faster rate than is allowed by the surface on which the tires are riding.

- The hydraulic shuttle valve closes upon brake application so that the pump/motor cannot siphon brake fluid from the master cylinder.

- The normally open and normally closed valves modulate (build/decay) the brake hydraulic pressure as required.

- The pump/motor is switched on so that the brake fluid from the low pressure accumulators is returned to the master cylinder circuits.

- The brake fluid is routed to either the master cylinder or the wheel brake depending on the position of the normally open valve.



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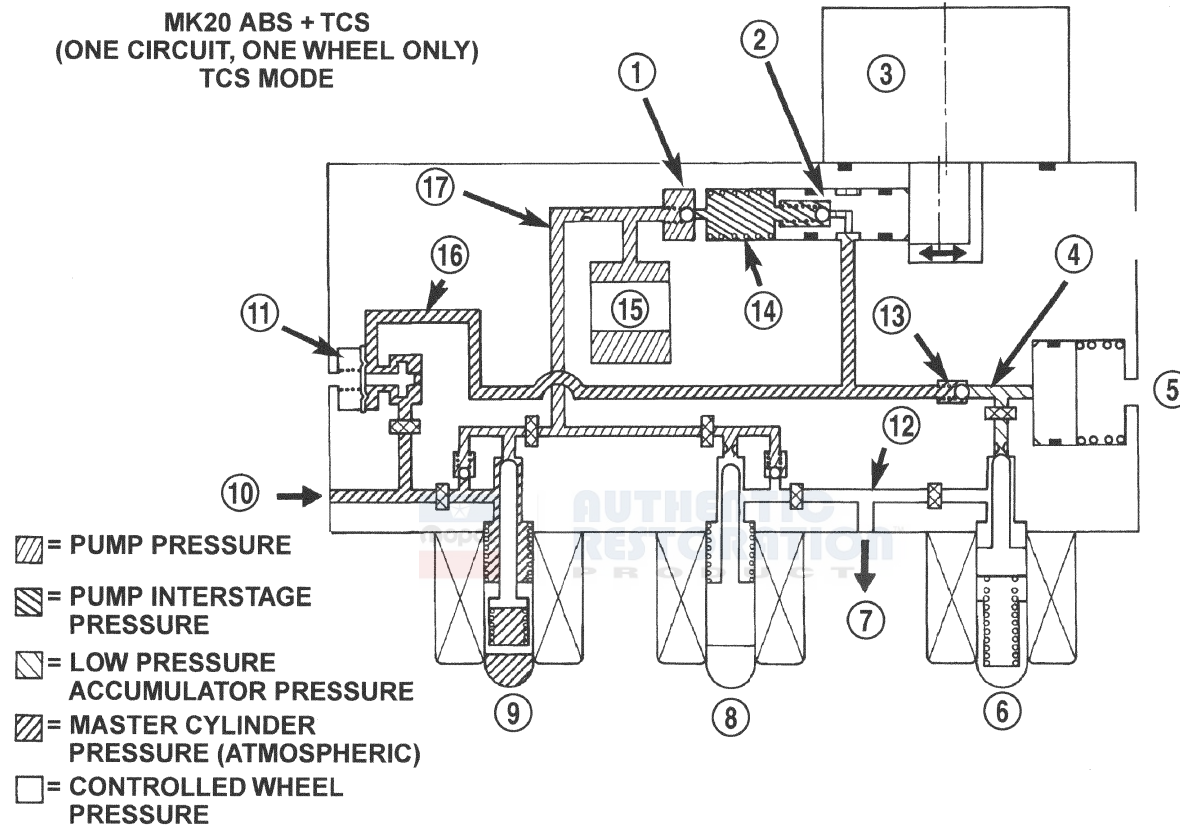
**Fig. 14 ABS With Traction Control - ABS Mode Hydraulic Circuit**

- |  |  |
|--|--|
| 1 - OUTLET VALVE                       | 9 - NORMALLY OPEN ASR VALVE (OFF)      |
| 2 - PUMP PISTON                        | 10 - FROM MASTER CYLINDER              |
| 3 - PUMP MOTOR (ON)                    | 11 - HYDRAULIC SHUTTLE VALVE           |
| 4 - SUCTION VALVE                      | 12 - MASTER CYLINDER PRESSURE          |
| 5 - LOW PRESSURE ACCUMULATOR           | 13 - CONTROLLED WHEEL PRESSURE         |
| 6 - NORMALLY CLOSED VALVE (MODULATING) | 14 - LOW PRESSURE ACCUMULATOR PRESSURE |
| 7 - TO RIGHT FRONT WHEEL               | 15 - PUMP INTERSTAGE PRESSURE          |
| 8 - NORMALLY OPEN VALVE (MODULATING)   | 16 - NOISE DAMPER CHAMBER              |

**DESCRIPTION AND OPERATION (Continued)****ABS TRACTION CONTROL HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)**

The hydraulic diagram (Fig. 15) shows the vehicle in the ABS braking mode. The diagram shows a drive wheel is spinning and brake pressure is required to reduce its speed.

- The normally open ASR valve is energized to isolate the brake fluid being pumped from the master cylinder and to isolate the driven wheel.
- The normally open ASR valve bypasses the pump output back to the master cylinder at a fixed pressure setting.
- The normally open and normally closed valves modulate (build/decay) the brake pressure as required to the spinning wheel.



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**Fig. 15 Traction Control Hydraulic Circuit**

- |   |                                |
|---|--------------------------------|
| 1 - OUTLET VALVE                            | 10 - FROM MASTER CYLINDER      |
| 2 - PUMP PISTON                             | 11 - HYDRAULIC SHUTTLE VALVE   |
| 3 - PUMP MOTOR (ON)                         | 12 - CONTROLLED WHEEL PRESSURE |
| 4 - LOW PRESSURE ACCUMULATOR PRESSURE       | 13 - SUCTION VALVE             |
| 5 - LOW PRESSURE ACCUMULATOR                | 14 - PUMP INTERSTAGE PRESSURE  |
| 6 - NORMALLY CLOSED VALVE (MODULATING)      | 15 - NOISE DAMPER CHAMBER      |
| 7 - TO RIGHT FRONT WHEEL (SPINNING)         | 16 - MASTER CYLINDER PRESSURE  |
| 8 - NORMALLY OPEN VALVE (MODULATING)        | 17 - PUMP PRESSURE             |
| 9 - NORMALLY OPEN ASR VALVE ON (REGULATING) |                                |



## DIAGNOSIS AND TESTING

### SERVICE WARNINGS AND CAUTIONS

The ABS uses an electronic control module, the CAB. This module is designed to withstand normal current draws associated with vehicle operation. Care must be taken to avoid overloading the CAB circuits.

**CAUTION:** In testing for open or short circuits, do not ground or apply voltage to any of the circuits unless instructed to do so for a diagnostic procedure.

**CAUTION:** These circuits should only be tested using a high impedance multi-meter or the DRB scan tool as described in this section. Power should never be removed or applied to any control module with the ignition in the ON position. Before removing or connecting battery cables, fuses, or connectors, always turn the ignition to the OFF position.

**CAUTION:** Use only factory wiring harnesses. Do not cut or splice wiring to the brake circuits. The addition of after-market electrical equipment (car phone, radar detector, citizen band radio, trailer lighting, trailer brakes, etc.) on a vehicle equipped with antilock brakes may affect the function of the antilock brake system.

### ABS GENERAL DIAGNOSTICS INFORMATION

This section contains information necessary to diagnose the antilock brake system. Specifically, this section should be used to help diagnose conditions which result in any of the following:

- (1) amber ABS warning lamp turned on.
- (2) brakes lock-up on hard application.

Diagnosis of base brake conditions that are obviously mechanical in nature should be directed to BASE BRAKE SYSTEM at the beginning of this group.

Many ABS conditions judged to be a problem by the driver may be normal operating conditions. See ABS OPERATION in the DESCRIPTION AND OPERATION section of this group to become familiarized with the normal characteristics of this antilock brake system.

### ABS WIRING DIAGRAM INFORMATION

During the diagnosis and testing of the antilock brake system it may become necessary to reference

the wiring diagrams covering the antilock brake system and its components. For wiring diagrams refer to GROUP 8W of this service manual. It will provide you with the wiring diagrams and the circuit description and operation information covering the antilock brake system.

### ABS VEHICLE TEST DRIVE

Most ABS complaints will require a test drive to properly duplicate and diagnose the condition.

### WARNING: CONDITIONS THAT RESULT IN TURNING ON THE RED BRAKE WARNING LAMP MAY INDICATE REDUCED BRAKING ABILITY.

Before test driving a brake complaint vehicle, note whether the red BRAKE warning lamp, amber ABS warning lamp, or both are turned on. If it is the red BRAKE warning lamp, there is a brake hydraulic problem that must be corrected before driving the vehicle. Refer to the BASE BRAKE SYSTEM for diagnosis of the red BRAKE warning lamp. If the red brake warning lamp is illuminated, there is also a possibility that there is an ABS problem and the amber ABS warning lamp is not able to illuminate, so the CAB turns on the red Brake warning lamp by default.

If the amber ABS warning lamp is on, test drive the vehicle as described below. While the amber ABS warning lamp is on, the ABS is not functional. The ability to stop the car using the base brake system should not be affected.

If a functional problem of the ABS is determined while test driving the vehicle, refer to the Chassis Diagnostic Procedures manual.

(1) Turn the key to the OFF position and then back to the ON position. Note whether the amber ABS warning lamp continues to stay on. If it does, refer to the diagnostic manual.

(2) If the amber ABS warning lamp goes out, shift into gear and drive the car to a speed of 25 kph (15 mph) to complete the ABS start-up and drive-off cycles (see ABS ELECTRONIC DIAGNOSIS). If at this time the amber ABS warning lamp comes on, refer to the diagnostic manual.

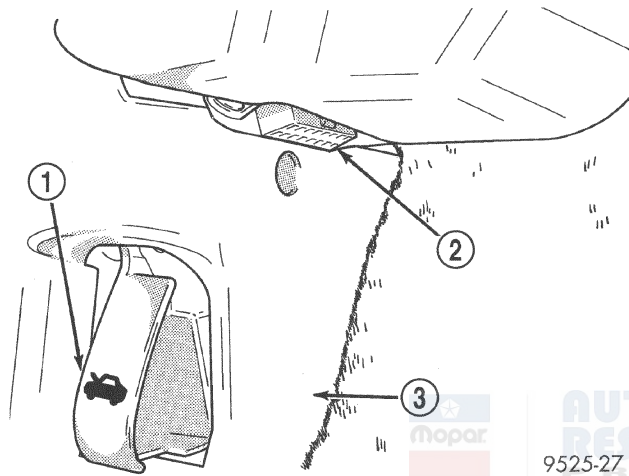
(3) If the amber ABS warning lamp remains out, drive the vehicle a short distance. Accelerate the vehicle to a speed of at least 40 mph. Bring the vehicle to a complete stop, braking hard enough to cause the ABS to cycle. Again accelerate the vehicle past 25 mph. Refer to the diagnostic manual for further testing of the antilock brake system.

## DIAGNOSIS AND TESTING (Continued)

### ABS ELECTRONIC DIAGNOSIS

The following information is presented to give the technician a general background on the diagnostic capabilities of the ABS system. Complete electronic diagnosis of the ABS system used on this vehicle is covered in the Chassis Diagnostics Procedures manual.

Electronic diagnosis of the ABS used on this vehicle is performed using the DRB scan tool. The vehicle's scan tool diagnostic connector is located under the instrument panel, directly next to the left side kick panel (Fig. 16).



**Fig. 16 ABS System Diagnostic Connector Location**

- 1 - HOOD RELEASE
- 2 - DIAGNOSTIC CONNECTOR
- 3 - DRIVER'S SIDE KICK PANEL

### ABS SELF-DIAGNOSIS

The ABS system is equipped with a self-diagnosis capability, which may be used to assist in the isolation of ABS faults. The features are described below.

#### START-UP CYCLE

The self-diagnosis ABS start-up cycle begins when the ignition switch is turned to the ON position. Electrical checks are completed on ABS components, including the CAB, system power, wiring and wheel speed sensors. During this check the amber ABS warning lamp is turned on for approximately 5 seconds and the brake pedal may emit a popping sound, moving slightly when the solenoid valves are checked.

#### DRIVE-OFF CYCLE

The first time the vehicle is set in motion after an ignition off/on cycle, the drive-off cycle occurs. This cycle is performed when the vehicle reaches a speed of approximately 25 kph (15 mph.). If the brakes are in a state of application as the vehicle reaches and surpasses the speed of 25 kph (15 mph.), the drive-off cycle will occur when the vehicle reaches a speed of

approximately 40 kph (24 mph.) regardless of brake (or brake pedal) application.

- The pump/motor is briefly activated to verify function. When the pump/motor is briefly activated, a whirling or buzzing sound may be heard by the driver. This sound is normal, indicating the pump/motor is running.
- The wheel speed sensor output correct operating range is verified.

### ONGOING TESTS

While the system is operating, these tests are performed on a continuous basis:

- solenoid continuity
- wheel speed sensor continuity
- wheel speed sensor output
- system voltage
- CAB self-diagnosis
- CCD monitor

### DIAGNOSTIC TROUBLE CODES (DTC's)

Diagnostic trouble codes (DTC's) are kept in the controller's memory until either erased by the technician using the DRB, or erased automatically after 3500 miles. DTC's are retained by the controller even if the ignition is turned off or the battery is disconnected. More than one DTC can be stored at a time. When accessed, the number of occurrences and the DTC that is stored are displayed. Most functions of the CAB and the ABS system can be accessed by the technician for testing and diagnostic purposes using the DRB.

### LATCHING VERSUS NON-LATCHING DIAGNOSTIC TROUBLE CODES

Some DTC's detected by the CAB are "latching" codes. The DTC is latched and ABS braking is disabled until the ignition switch is reset. Thus, ABS braking is non-operational even if the original DTC has disappeared. Other DTC's are non-latching. Any warning lamps that are turned on are only turned on as long as the DTC condition exists; as soon as the condition goes away, the amber ABS warning lamp is turned off, although, in most cases, a DTC is set.

### INTERMITTENT DIAGNOSTIC TROUBLE CODES

As with virtually any electronic system, intermittent electrical problems in the ABS system may be difficult to accurately diagnose. Most intermittent electrical problems are caused by faulty electrical connections or wiring. A visual inspection should be done before trying to diagnose or service the antilock brake system; this will eliminate unnecessary diagnosis and testing time. Perform a visual inspection for loose, disconnected, damaged, or misrouted wires or connectors; include the following components and areas of the vehicle in the inspection.



**DIAGNOSIS AND TESTING (Continued)**

(1) Inspect fuses in the power distribution center (PDC) and the wiring junction block. Verify that all fuses are fully inserted into the PDC and wiring junction block. A label on the underside of the PDC cover identifies the locations of the ABS fuses.

(2) Inspect the 25-way electrical connector at the CAB for damaged, spread, or backed-out wiring terminals. Verify that the 25-way connector is fully inserted in the socket of the CAB. Be sure that wires are not stretched tight or pulled out of the connector.

(3) Verify that all the wheel speed sensor connections are secure.

(4) Look for poor mating of connector halves or terminals not fully seated in the connector body.

(5) Check for improperly formed or damaged terminals. All connector terminals in a suspect circuit should be carefully reformed to increase contact tension.

(6) Look for poor terminal-to-wire connections. This requires removing the terminal from the connector body to inspect it.

(7) Verify pin presence in the connector assembly

(8) Check for proper ground connections. Check all ground connections for signs of corrosion, loose fasteners, or other potential defects. Refer to the wiring diagrams for ground locations.

(9) Look for problems with the main power sources of the vehicle. Inspect the battery, generator, ignition circuits and related relays and fuses.

If a visual check does not find the cause of the problem, operate the car in an attempt to duplicate the condition and record any trouble codes.

Most failures of the ABS disable the ABS function for the entire ignition cycle even if the fault clears before key-off. There are some failure conditions, however, that allow ABS operation to resume during the ignition cycle in which the trouble occurred even if the trouble conditions are no longer present.

The following trouble conditions may result in intermittent illumination of the amber ABS warning lamp.

- Low system voltage. If Low System Voltage is detected by the CAB, the CAB will turn on the Amber ABS Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the CAB, normal operation resumes.

Additional possible causes that may result in the illumination of the amber ABS warning lamp are as follows:

- High system voltage. If high system voltage is detected by the CAB, the CAB will turn on the Amber ABS Warning Lamp. If the ignition key is cycled and normal voltage is again detected by the

CAB, normal ABS operation resumes and the lamp remains off.

- Any condition that interrupts electrical current to the CAB may cause the amber ABS warning lamp to turn on intermittently.

- If CCD communication between the mechanical instrument cluster (MIC) and the CAB is interrupted, the MIC can turn on the amber ABS warning lamp.

**TONE WHEEL**

Tone wheels can cause erratic wheel speed sensor signals. Inspect tone wheels for the following possible causes:

- missing, chipped, or broken teeth
- contact with the wheel speed sensor
- wheel speed sensor to tone wheel alignment
- wheel speed sensor to tone wheel clearance
- excessive tone wheel runout
- tone wheel loose on its mounting surface

If a front tone wheel is found to need replacement, the drive shaft must be replaced. No attempt should be made to replace just the tone wheel. Refer to the DIFFERENTIAL AND DRIVELINE group in this service manual for removal and installation.

If a rear tone wheel is found to need replacement, the rear hub and bearing must be replaced. No attempt should be made to replace just the tone wheel. Refer to the SUSPENSION group in this service manual for removal and installation.

If wheel speed sensor to tone wheel contact is evident, determine the cause and correct it before replacing the wheel speed sensor or tone wheel.

Check the gap between the speed sensor head and the tone wheel to ensure it is within specifications. Refer to SPECIFICATIONS in this section of the service manual for the minimum and maximum wheel speed sensor to tone wheel clearance.

Excessive wheel speed sensor runout can cause erratic wheel speed sensor signals. Refer to SPECIFICATIONS in this section of the service manual for the maximum allowed tone wheel runout. If tone wheel runout is excessive, determine if it is caused by a defect in the driveshaft assembly or hub and bearing. Replace as necessary.

Tone wheels are pressed onto their mounting surfaces and should not rotate independently from the mounting surface. Replacement of the front driveshaft or rear hub and bearing is necessary.



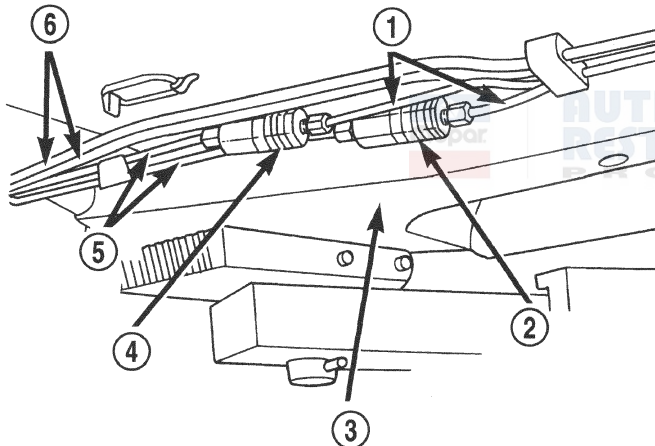
## DIAGNOSIS AND TESTING (Continued)

### PROPORTIONING VALVE

**NOTE:** The following procedure is for the diagnosis and testing of the proportioning valve(s) on a vehicle equipped with ABS. For diagnosis and testing of proportioning valves on a vehicle without ABS, Refer to the **BASE BRAKE SYSTEM** section in this group.

If a condition of premature rear wheel skid occurs on a vehicle, the proportioning valve should always be tested prior to it being replaced. This is due to the fact that there are conditions other than a faulty proportioning valve which can cause a premature rear wheel skid.

One proportioning valve controls the right rear brake, and the other proportioning valve controls the left rear brake (Fig. 17). Therefore, a road test to determine which rear brake slides first is essential. Once the wheel which is skidding first is determined, use the following procedure to diagnose the proportioning valve.

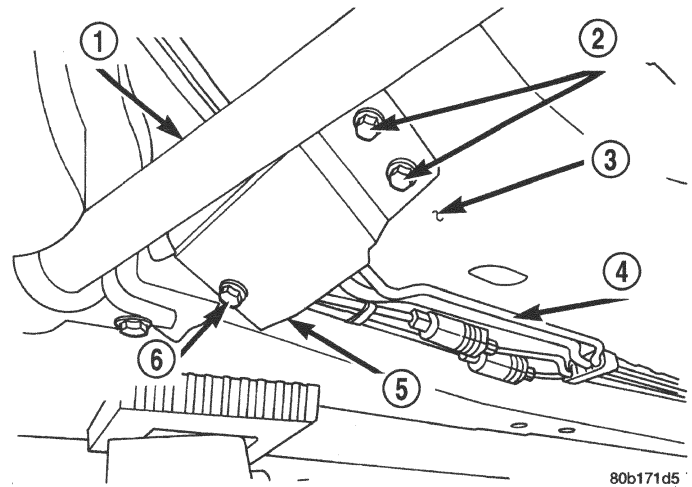


**Fig. 17 Proportioning Valve Location**

- 1 - CHASSIS BRAKE TUBES
- 2 - RIGHT REAR BRAKE PROPORTIONING VALVE
- 3 - RIGHT FRAME RAIL
- 4 - LEFT REAR BRAKE PROPORTIONING VALVE
- 5 - CHASSIS BRAKE TUBES
- 6 - FUEL TUBES

The test procedure is the same for both rear wheel proportioning valves. After road testing vehicle to determine which wheel skids first, follow the procedure below for testing the required proportioning valve.

(1) Remove the cover (Fig. 18) securing the chassis brake tubes and the fuel lines to the vehicle floor pan.



**Fig. 18 Tube Bundle Cover**

- 1 - STABILIZER BAR
- 2 - MOUNTING BOLTS
- 3 - FLOOR PAN
- 4 - TUBE BUNDLE
- 5 - COVER
- 6 - MOUNTING BOLT

(2) Remove the chassis brake tubes (Fig. 17) from the proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

(3) Remove the proportioning valve from the rear brake chassis tube.

(4) Remove the routing clips for the chassis brake tubes and fuel lines from the floor pan.

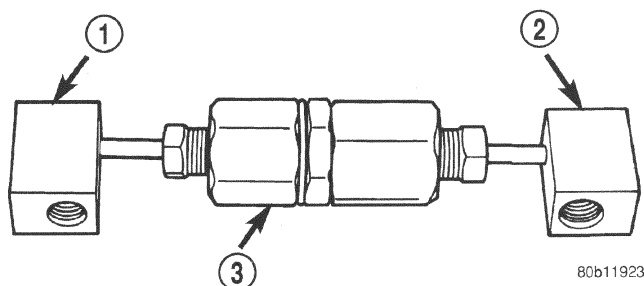
**CAUTION:** The chassis brake tube must be removed from the routing clips. This is to prevent the chassis brake tube from having to be bent when installing the proportioning valve with the pressure test fittings.

(5) Remove the chassis brake tube that requires testing of its proportioning valve from the routing clips.

**CAUTION:** Be sure the pressure test fittings being installed into the proportioning valve have the correct thread sizes and flares for installation into the proportioning valve and for installation of the chassis brake tubes.

**DIAGNOSIS AND TESTING (Continued)**

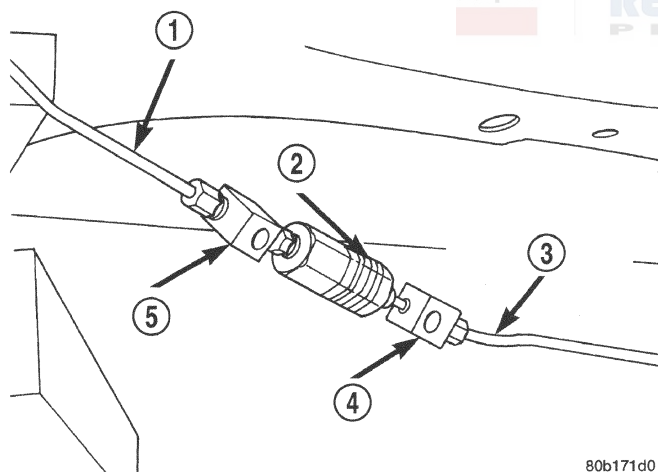
(6) Install Pressure Test Fitting, Special Tool 6833-1 in the inlet port of the proportioning valve (Fig. 19). Install Pressure Test Fitting, Special Tool 8187-2 in the outlet port of the proportioning valve (Fig. 19). Tighten tube nuts to a torque of 17 N·m (145 in. lbs.).



**Fig. 19 Pressure Test Fittings Installed On Proportioning Valve**

- 1 - SPECIAL TOOL 8187-2
- 2 - SPECIAL TOOL 6833-1
- 3 - PROPORTIONING VALVE

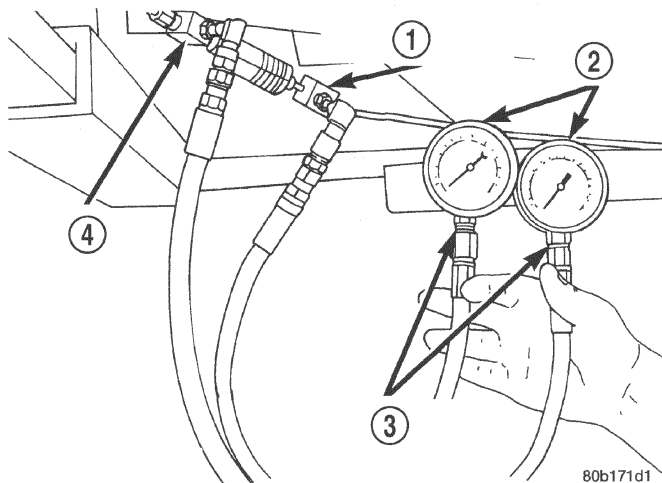
(7) Install the proportioning valve with the pressure test fittings installed, in the chassis brake tube (Fig. 20). Tighten both tube nuts to a torque of 17 N·m (145 in. lbs.).



**Fig. 20 Proportioning Valve With Pressure Test Fittings Installed**

- 1 - CHASSIS BRAKE TUBE FROM HCU
- 2 - PROPORTIONING VALVE
- 3 - CHASSIS BRAKE TUBE TO REAR BRAKE
- 4 - SPECIAL TOOL 8187-2
- 5 - SPECIAL TOOL 6833-1

(8) Install a Pressure Gauge, Special Tool C-4007-A into each pressure test fitting (Fig. 21). Bleed air out of hose from pressure test fitting to pressure gauge, at pressure gauge to remove all trapped air.



**Fig. 21 Pressure Gauges Installed On Pressure Test Fittings**

- 1 - PRESSURE TEST FITTING
- 2 - SPECIAL TOOL C-4007-A
- 3 - BLEED AIR FROM BOTH PRESSURE GAUGES HERE
- 4 - PRESSURE TEST FITTING

(9) With the aid of a helper, apply pressure to the brake pedal until reading on proportioning valve inlet gauge, is at the pressure shown on the following chart, PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS. Then check the pressure reading on the proportioning valve outlet gauge. If proportioning valve outlet pressure does not agree with value shown on the following chart, when inlet pressure shown on chart is obtained, replace the proportioning valve. If proportioning valve is within pressure specifications do not replace proportioning valve.

(10) Check rear wheel brake shoe linings for contamination or for replacement brake shoes not meeting OEM brake lining material specifications. These conditions can also be a possible cause for a premature rear wheel skid.

(11) Install proportioning valve on end of brake flex hose. Tighten the proportioning valve to a torque of 17 N·m (145 in. lbs.).

(12) Install brake tube on proportioning valve. Torque tube nut to 17 N·m (145 in. lbs.) torque.

(13) Bleed the affected brake line. Refer to BASE BRAKE BLEEDING in the SERVICE PROCEDURES section.

**DIAGNOSIS AND TESTING (Continued)****PROPORTIONING VALVE APPLICATIONS AND PRESSURE SPECIFICATIONS**

Sales Code	Brake System Type	Split Point	Slope	Identification	Inlet Pressure	Outlet Pressure
BRA	14" Disc/Drum	600 psi	0.59	Bar Code Label	1000 psi	800-900 psi
BRJ	14" Disc/Drum W/ABS	600 psi	0.59	Bar Code Label	1000 psi	800-900 psi
BRF	14" Disc/Disc W/ABS	500 psi	0.43	Bar Code Label	1000 psi	600-700 psi

**BRAKE FLUID CONTAMINATION**

Indications of fluid contamination are swollen or deteriorated rubber parts. Swelling indicates the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If the fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If the brake fluid is contaminated, drain and thoroughly flush the brake system. Replace all the rubber parts or components containing rubber coming into contact with the brake fluid including: the master cylinder; proportioning valves; caliper seals; wheel cylinder seals; ABS hydraulic control unit; and all hydraulic fluid hoses.

It is important to note that excessive air in the brake system will cause a soft or spongy feeling brake pedal.

During the brake bleeding procedure, be sure the brake fluid level remains close to the FULL level in the master cylinder fluid reservoir. Check the fluid level periodically during the bleeding procedure and add DOT 3 brake fluid as required.

The ABS must be bled as two independent braking systems. The non-ABS portion of the brake system with ABS is to be bled the same as any non-ABS system.

The ABS portion of the brake system must be bled separately. Use the following procedure to properly bleed the brake hydraulic system including the ABS.

**SERVICE PROCEDURES****BRAKE FLUID LEVEL CHECKING**

**CAUTION:** Use only Mopar brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

Refer to SERVICE PROCEDURES in the BASE BRAKE SYSTEM section in this group for the proper procedure to check and adjust the brake fluid level in the master cylinder fluid reservoir.

**ANTILOCK BRAKE SYSTEM BLEEDING**

The base brake's hydraulic system must be bled anytime air enters the hydraulic system. The ABS though, particularly the ICU (HCU), should only be bled when the HCU is replaced or removed from the vehicle. The ABS must always be bled anytime it is suspected that the HCU has ingested air. Under most circumstances that require the bleeding of the brakes hydraulic system, only the base brake hydraulic system needs to be bled.

**BLEEDING**

When bleeding the ABS system, the following bleeding sequence must be followed to insure complete and adequate bleeding.

(1) Make sure all hydraulic fluid lines are installed and properly torqued.

(2) Connect the DRB scan tool to the diagnostics connector. The diagnostic connector is located under the lower steering column cover to the left of the steering column.

(3) Using the DRB, check to make sure the CAB does not have any fault codes stored. If it does, clear them using the DRB.

**WARNING: WHEN BLEEDING THE BRAKE SYSTEM WEAR SAFETY GLASSES. A CLEAR BLEED TUBE MUST BE ATTACHED TO THE BLEEDER SCREWS AND SUBMERGED IN A CLEAR CONTAINER FILLED PART WAY WITH CLEAN BRAKE FLUID. DIRECT THE FLOW OF BRAKE FLUID AWAY FROM YOURSELF AND THE PAINTED SURFACES OF THE VEHICLE. BRAKE FLUID AT HIGH PRESSURE MAY COME OUT OF THE BLEEDER SCREWS WHEN OPENED.**



## SERVICE PROCEDURES (Continued)

(4) Bleed the base brake system using the standard pressure or manual bleeding procedure as outlined in SERVICE PROCEDURES in the BASE BRAKE SYSTEM section at the beginning of this group.

(5) Using the DRB, select ANTILOCK BRAKES, followed by MISCELLANEOUS, then BLEED BRAKES. Follow the instructions displayed. When the scan tool displays TEST COMPLETED, disconnect the scan tool and proceed.

(6) Bleed the base brake system a second time. Check brake fluid level in the reservoir periodically to prevent emptying, causing air to enter the hydraulic system.

(7) Fill the master cylinder reservoir to the full level.

(8) Test drive the vehicle to be sure the brakes are operating correctly and that the brake pedal does not feel spongy.

## REMOVAL AND INSTALLATION

### SERVICE WARNINGS AND CAUTIONS

Review this entire section prior to performing any mechanical work on a vehicle equipped with ABS. This section contains information on precautions pertaining to potential component damage, vehicle damage and personal injury which could result when servicing an ABS equipped vehicle.

**CAUTION:** Only the recommended jacking or hoisting positions for this vehicle are to be used whenever it is necessary to lift a vehicle. Failure to raise a vehicle from the recommended locations could result in lifting a vehicle by the hydraulic control unit mounting bracket. Lifting a vehicle by the hydraulic control unit mounting bracket will result in damage to the mounting bracket and the hydraulic control unit.

**CAUTION:** An attempt to remove or disconnect certain system components may result in improper system operation. Only those components with approved removal and installation procedures in this manual should be serviced.

**CAUTION:** Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

**CAUTION:** When performing any service procedure on a vehicle equipped with ABS do not apply a 12-volt power source to the ground circuit of the pump motor in the HCU. Doing this will damage the pump motor and will require replacement of the entire HCU.

**CAUTION:** If welding work is to be performed on the vehicle, using an electric arc welder, the CAB connector should be disconnected during the welding operation.

**CAUTION:** The CAB 25-way connector should never be connected or disconnected with the ignition switch in the ON position.

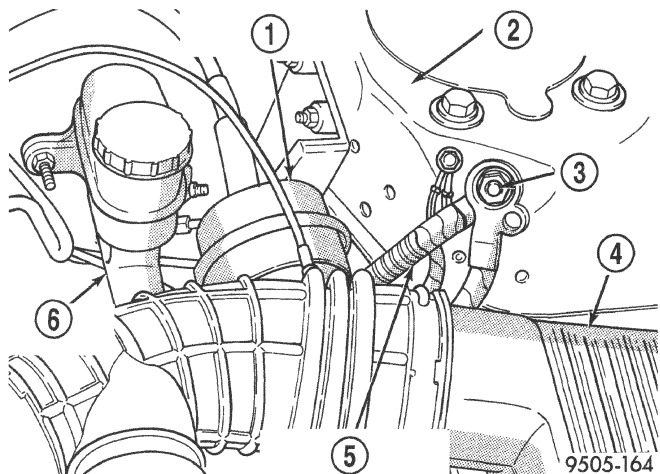
Many components of the ABS System are not serviceable and must be replaced as an assembly. Do not disassemble any component which is not designed to be serviced.

## INTEGRATED CONTROL UNIT

**NOTE:** Before proceeding, review SERVICE WARNINGS AND CAUTIONS at the beginning of this REMOVAL AND INSTALLATION section.

### REMOVAL

(1) Remove the remote ground cable from the ground stud on the left strut tower (Fig. 22).

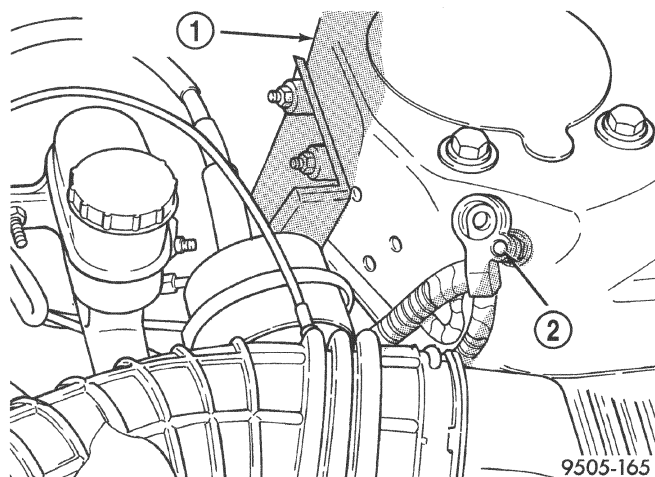


**Fig. 22 Remote Ground Cable Attachment To Strut Tower**

- 1 - SPEED CONTROL SERVO
- 2 - LEFT STRUT TOWER
- 3 - GROUND STUD
- 4 - AIR CLEANER
- 5 - REMOTE GROUND CABLE
- 6 - MASTER CYLINDER

## REMOVAL AND INSTALLATION (Continued)

(2) Correctly isolate remote ground cable when servicing vehicle by installing the ground cable insulator on the strut tower ground stud as shown in (Fig. 23) and installing the nut on the stud. **This will prevent accidental grounding of the remote ground cable.**



**Fig. 23 Correctly Isolated Remote Ground Cable**

- 1 - LEFT STRUT TOWER
- 2 - GROUND STUD

(3) Using a brake pedal positioning tool such as shown in (Fig. 24) depress brake pedal past its first 1 inch of travel and hold in this position. This will isolate the master cylinder reservoir from the brake hydraulic system, not allowing the brake fluid to drain out of the reservoir.

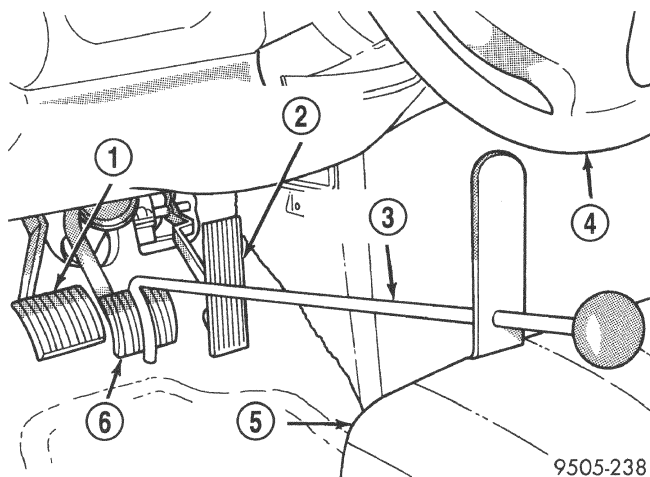
(4) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

(5) Remove the splash shield (Fig. 25) from the right side of the engine compartment.

(6) Remove entire exhaust system from the vehicle as a complete assembly using the following steps.

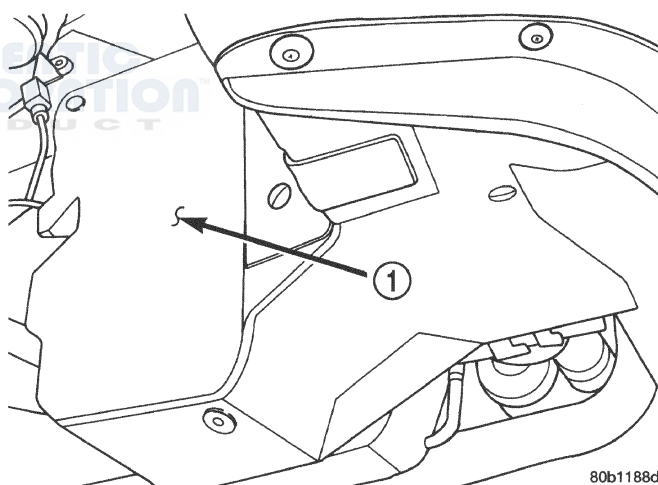
(a) Disconnect the oxygen sensor wiring harnesses from the vehicle wiring harness.

(b) Remove the ground strap between the frame and muffler at the muffler bracket.



**Fig. 24 Brake Pedal Holding Tool Installed**

- 1 - CLUTCH PEDAL (IF EQUIPPED WITH MANUAL TRANSAXLE)
- 2 - THROTTLE PEDAL
- 3 - BRAKE PEDAL HOLDING TOOL
- 4 - STEERING WHEEL
- 5 - DRIVER'S SEAT
- 6 - BRAKE PEDAL

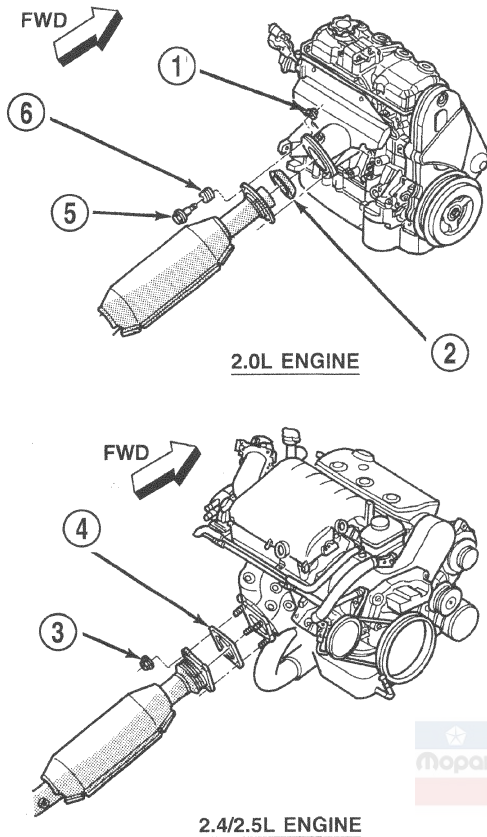


**Fig. 25 Right Side Splash Shield**

- 1 - SPLASH SHIELD

**REMOVAL AND INSTALLATION (Continued)**

(c) Remove attaching bolts from exhaust pipe at exhaust manifold on engine (Fig. 26).



**Fig. 26 Exhaust Pipe Mounting To Exhaust Manifold**

- 1 - NUTS
- 2 - SEAL RING
- 3 - NUTS 32 N-M (24 FT. LBS.)
- 4 - GASKET
- 5 - SHOULDER BOLT 28 N-M (250 IN. LBS.)
- 6 - SPRING

(d) Remove all exhaust system support/isolators from the vehicle's exhaust system (Fig. 27). Remove support/isolators from brackets on exhaust system components and leave attached to body of vehicle.

(e) Lower exhaust system as a complete assembly away from the underbody of the vehicle.

(7) Remove the heat shield for the HCU from the HCU mounting bracket (Fig. 28).

(8) Using Mopar, Brake Parts Cleaner or an equivalent, thoroughly clean all surfaces of the HCU. Also, thoroughly clean all brake tube to HCU connections.

(9) Remove the 4 chassis brake tubes from the outlet ports on the HCU (Fig. 29).

(10) Remove the primary and secondary brake tubes coming from the master cylinder from the HCU inlet ports (Fig. 30).

(11) Remove the bolt (Fig. 31) attaching the front leg of the HCU mounting bracket to the front suspension crossmember.

(12) Remove the 2 bolts (Fig. 32) attaching the back legs of the HCU mounting bracket to the front suspension crossmember.

(13) Remove bolt (Fig. 33) attaching the side of the HCU to the mounting bracket.

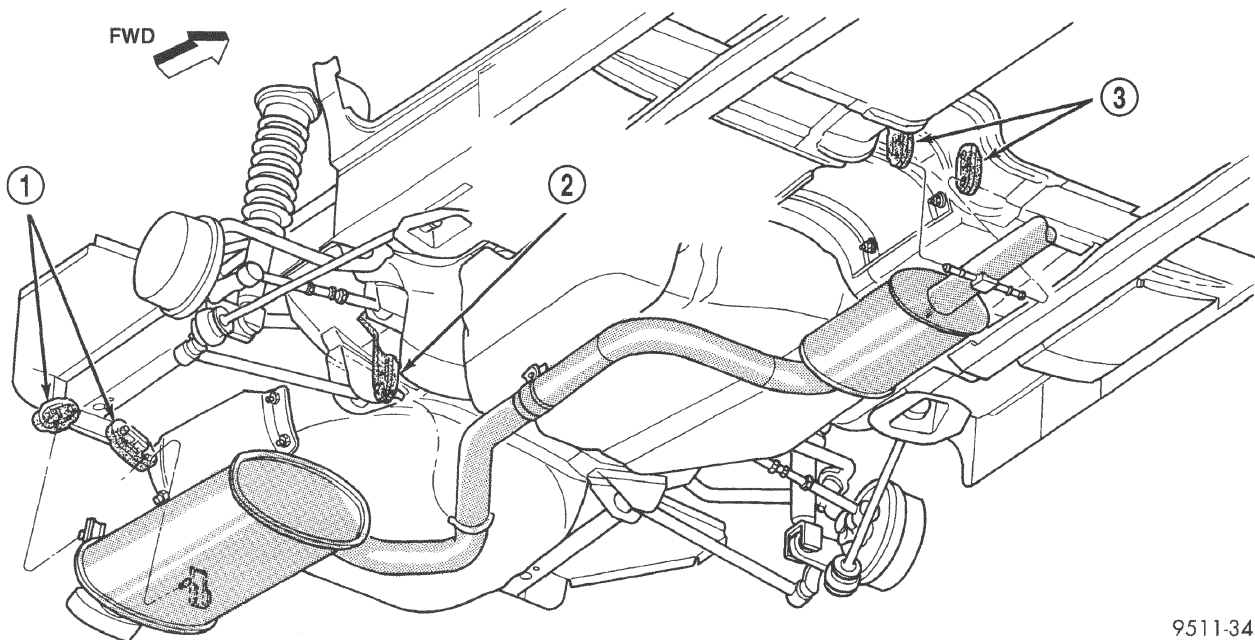
(14) Remove the 2 bolts (Fig. 34) attaching the top of the HCU to the mounting bracket.

**CAUTION:** Do not apply a 12-volt power source to any terminals of the 25-way CAB connector while disconnected from the CAB.

(15) Disconnect the 25-way wiring harness connector from the CAB using the following procedure. Grasp the lock on the 25-way connector and pull it out from the connector as far as possible (Fig. 35). This will unlock and raise the 25-way connector out of the socket on the CAB.



## REMOVAL AND INSTALLATION (Continued)

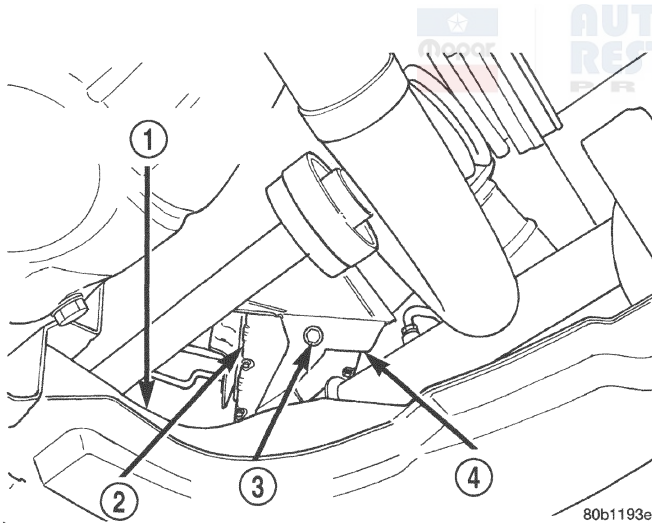


9511-34

**Fig. 27 Exhaust System Support/Isolator Locations**

- 1 - REAR MUFFLER SUPPORT ISOLATORS  
 2 - FRONT MUFFLER SUPPORT ISOLATOR

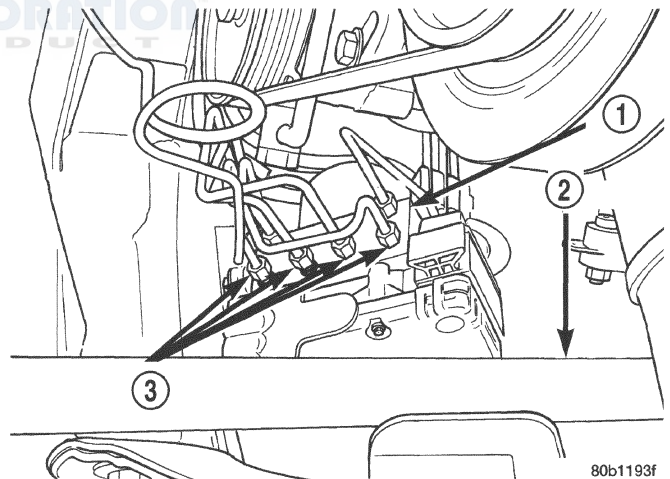
- 3 - RESONATOR SUPPORT ISOLATORS



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**Fig. 28 HCU Heat Shield**

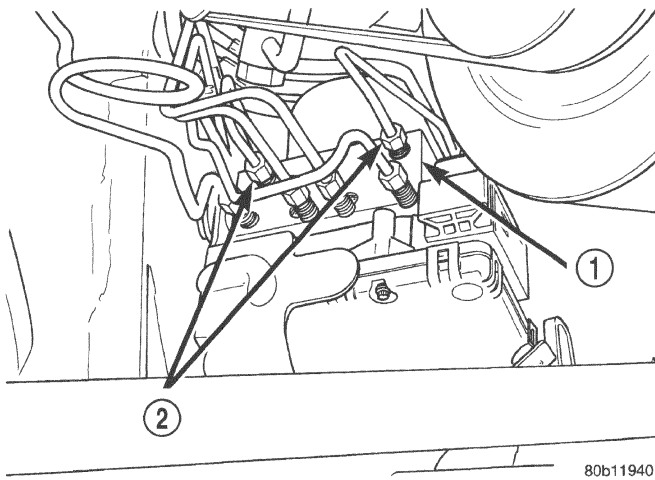
- 1 - FRONT SUSPENSION CROSSMEMBER  
 2 - HCU  
 3 - BOLT  
 4 - HEAT SHIELD



80b1193f

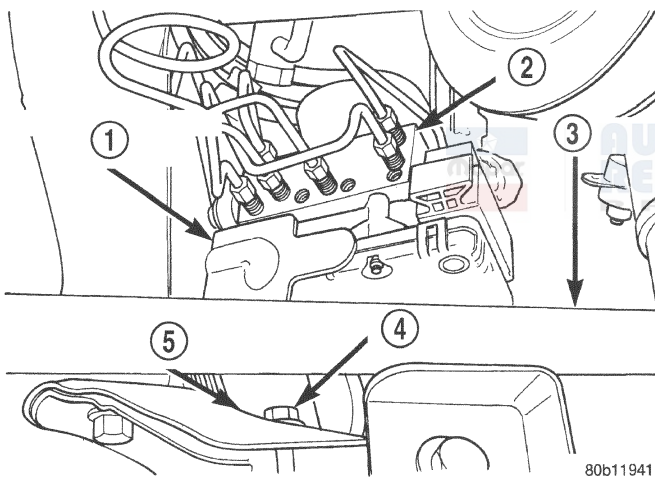
**Fig. 29 Chassis Brake Tube Connections To HCU**

- 1 - HCU  
 2 - DRIVESHAFT  
 3 - CHASSIS BRAKE TUBES

**REMOVAL AND INSTALLATION (Continued)**

**Fig. 30 Master Cylinder Brake Tube Connections To HCU**

- 1 - HCU
- 2 - MASTER CYLINDER BRAKE TUBES

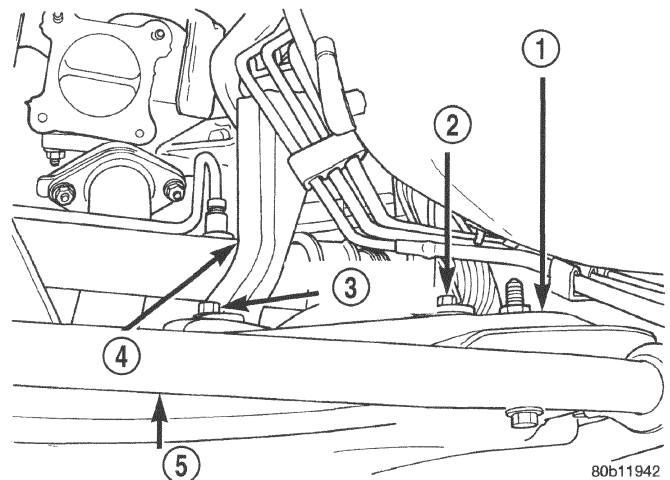


**Fig. 31 HCU Mounting Bracket Front Bolt**

- 1 - HCU MOUNTING BRACKET
- 2 - HCU
- 3 - DRIVESHAFT
- 4 - BOLT
- 5 - FRONT SUSPENSION CROSSMEMBER

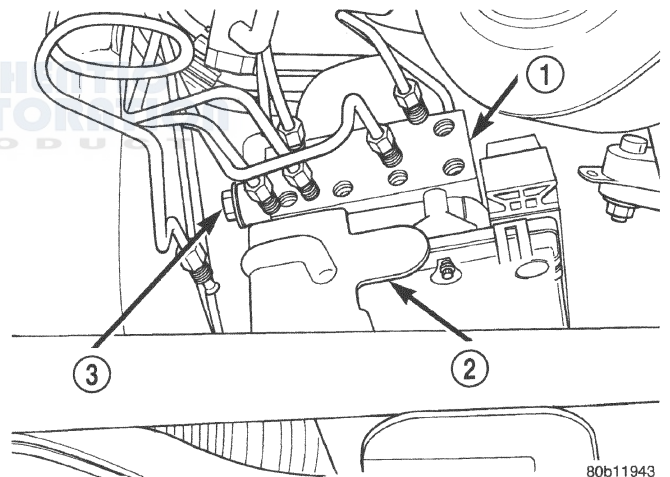
(16) Remove the ICU from its mounting bracket. Then remove the ICU from the vehicle by pulling it out through the area between the right drive shaft and frame rail (Fig. 36).

(17) Refer to INTEGRATED CONTROL UNIT in DISASSEMBLY AND ASSEMBLY within this section to separated the CAB from the HCU.



**Fig. 32 HCU Mounting Bracket Rear Bolts**

- 1 - FRONT SUSPENSION CROSSMEMBER
- 2 - MOUNTING BOLT
- 3 - MOUNTING BOLT
- 4 - HCU MOUNTING BRACKET
- 5 - STABILIZER BAR



**Fig. 33 HCU To Bracket Mounting Bolt**

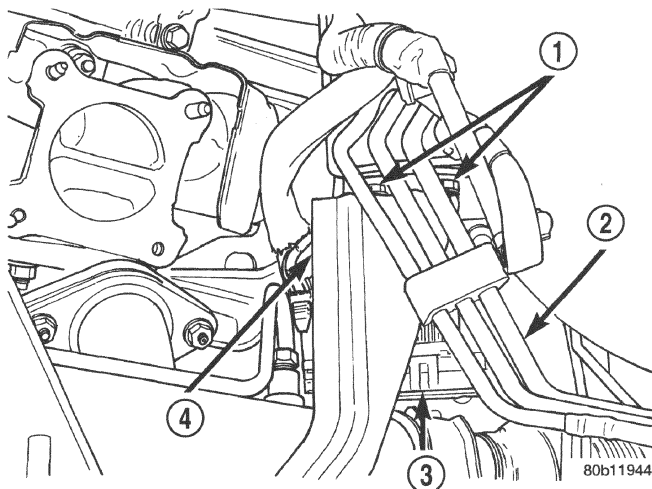
- 1 - HCU
- 2 - MOUNTING BRACKET
- 3 - MOUNTING BOLT

**INSTALLATION**

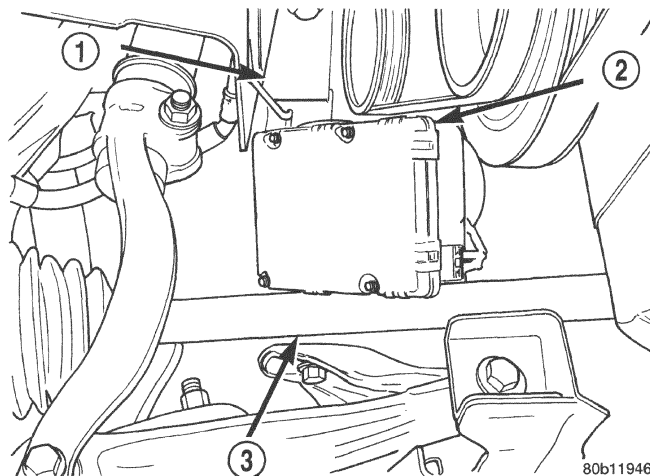
(1) Install the ICU back in the vehicle and on its mounting bracket using the reverse order of its removal.

(2) Install isolators, washers and attaching bolts, mounting the ICU to its mounting bracket (Fig. 33) and (Fig. 34).

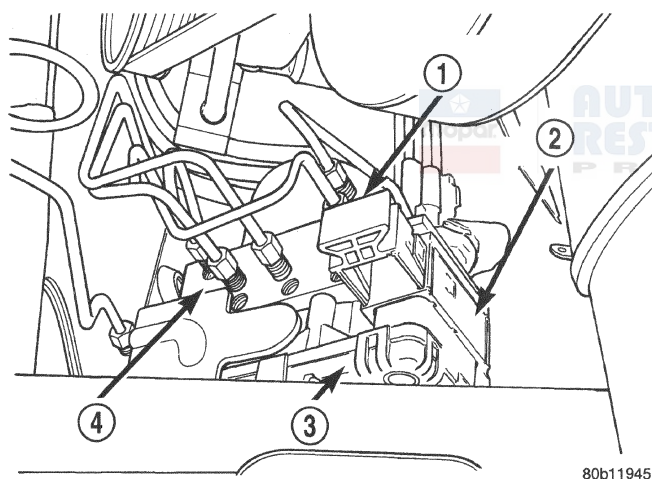
## REMOVAL AND INSTALLATION (Continued)

**Fig. 34 HCU To Bracket Mounting Bolt**

- 1 - MOUNTING BOLTS
- 2 - FUEL LINES
- 3 - HCU
- 4 - HCU MOUNTING BRACKET

**Fig. 36 ICU Remove And Install**

- 1 - FRAME RAIL
- 2 - ICU
- 3 - DRIVESHAFT

**Fig. 35 Unlocked CAB Connector**

- 1 - CONNECTOR LOCK
- 2 - CAB CONNECTOR
- 3 - CAB
- 4 - HCU

(3) Tighten the 3 HCU mounting bolts to a torque of 11 N·m (97 in. lbs.).

**CAUTION:** Before installing the 25-way connector in the CAB be sure that the seal is properly installed in the connector.

(4) Install the 25-way connector into the socket on the CAB. The connector is installed using the following procedure. Position the 25-way connector in the socket on the CAB and carefully push it down as far as it will go. When connector is fully seated into the

CAB socket push in the connector lock (Fig. 35) as far as it will go. This will pull the 25-way connector into the socket on the CAB and lock it in the installed position.

(5) Install the 2 bolts (Fig. 32) attaching the back legs of the HCU mounting bracket to the front suspension crossmember.

(6) Install the bolt (Fig. 31) attaching the front leg of the HCU mounting bracket to the front suspension crossmember.

(7) Tighten the 3 bolts mounting the HCU mounting to the front suspension crossmember to a torque of 28 N·m (250 in. lbs.).

(8) Install the primary and secondary brake tubes coming from the master cylinder in the HCU inlet ports (Fig. 30).

(9) Install the 4 chassis brake tubes in the outlet ports on the HCU (Fig. 29).

(10) Using a crow foot (Fig. 37) and (Fig. 38) tighten all of the brake tube nuts to a torque of 17 N·m (145 in. lbs.).

(11) Install the HCU heat shield (Fig. 28) on the HCU mounting bracket. Install and securely tighten the attaching bolt.

(12) Install exhaust system in vehicle using the reverse steps of its removal.

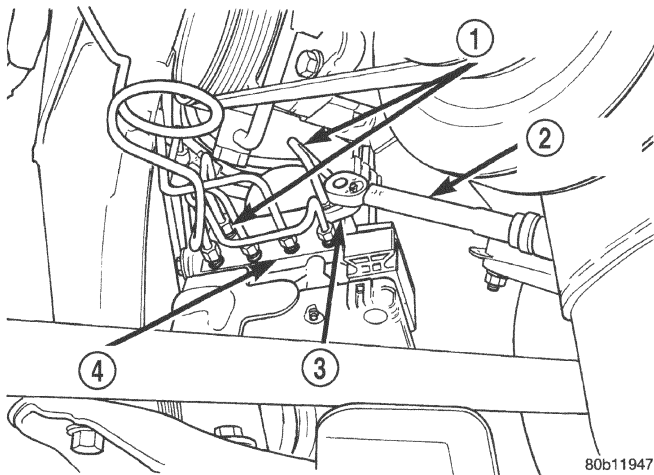
(13) Install right side engine compartment splash shield (Fig. 25) back on the vehicle.

(14) Lower vehicle.

(15) Remove brake pedal holding tool.

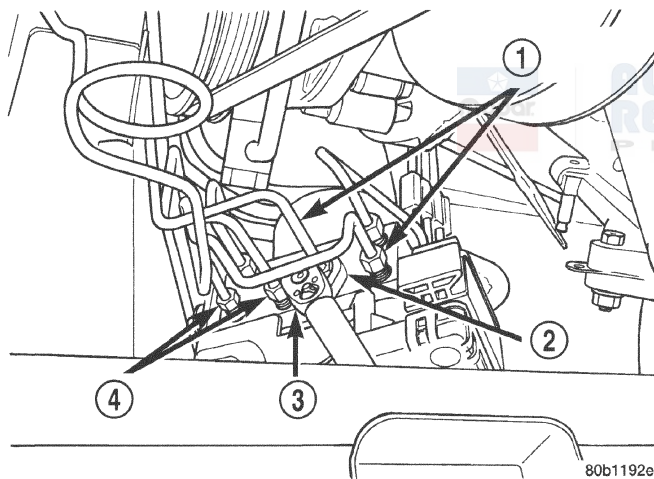
(16) Install the remote ground cable onto the ground stud located on left shock tower (Fig. 22). Install the remote ground cable attaching nut and tighten to a torque of 28 N·m (250 in. lbs.).



**REMOVAL AND INSTALLATION (Continued)**

**Fig. 37 Torquing Primary And Secondary Brake Tube Nut**

- 1 - PRIMARY AND SECONDARY BRAKE TUBES
- 2 - TORQUE WRENCH
- 3 - CROW FOOT
- 4 - HCU



**Fig. 38 Torquing Chassis Brake Tube Nuts**

- 1 - CHASSIS BRAKE TUBES
- 2 - CROW FOOT
- 3 - TORQUE WRENCH
- 4 - CHASSIS BRAKE TUBES

(17) Bleed the base brakes and the ABS brakes hydraulic system. Refer to the Bleeding ABS System in this section of the manual for the proper bleeding procedure.

(18) Road test vehicle to ensure proper operation of the base and ABS systems.

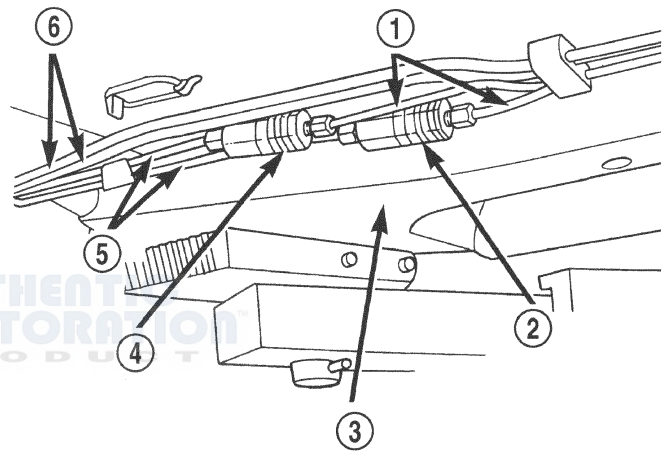
**PROPORTIONING VALVE**

**NOTE:** The following procedure is for the removal and installation of one of two proportioning valves on a vehicle equipped with ABS. For removal and installation of proportioning valves on a vehicle without ABS, Refer to the **BASE BRAKE SYSTEM** section in this group.

**REMOVAL**

(1) Remove the chassis brake tubes (Fig. 39) from the proportioning valve controlling the rear wheel of the vehicle which has premature wheel skid.

(2) Remove the proportioning valve from the rear brake chassis tube.



**Fig. 39 Proportioning Valve Location**

- 1 - CHASSIS BRAKE TUBES
- 2 - RIGHT REAR BRAKE PROPORTIONING VALVE
- 3 - RIGHT FRAME RAIL
- 4 - LEFT REAR BRAKE PROPORTIONING VALVE
- 5 - CHASSIS BRAKE TUBES
- 6 - FUEL TUBES

**INSTALLATION**

(1) Install the proportioning valve in the chassis brake tube.

(2) Tighten both tube nuts on the chassis brake tubes into the proportioning valve to a torque of 17 N·m (145 in. lbs.).

(3) Bleed the affected brake line. See **BRAKE SYSTEM BLEEDING** in the **SERVICE PROCEDURES** section of the **BASE BRAKE SYSTEM** section of this group.

**REMOVAL AND INSTALLATION (Continued)****WHEEL SPEED SENSOR (FRONT)**

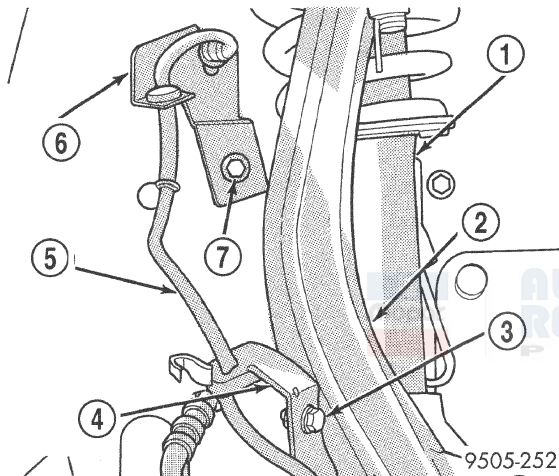
This procedure is for the removal and installation of one of the two front wheel speed sensors.

**REMOVAL**

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

(3) Remove the speed sensor cable routing bracket (Fig. 40) from the steering knuckle. Remove the wiring harness sealing grommet retainer and speed sensor routing bracket from the inner fender.



**Fig. 40 Speed Sensor Cable Routing Brackets**

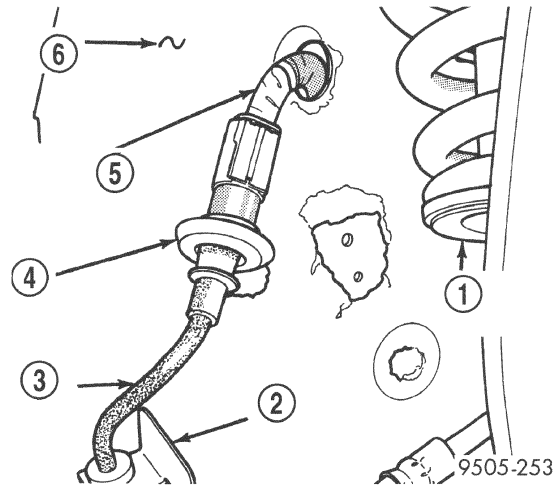
- 1 - SHOCK ABSORBER
- 2 - STEERING KNUCKLE
- 3 - BOLT
- 4 - SPEED SENSOR ROUTING BRACKET
- 5 - WHEEL SPEED SENSOR CABLE
- 6 - GROMMET RETAINER AND CABLE ROUTING BRACKET
- 7 - BOLT

(4) Remove speed sensor sealing grommet from the inner fender (Fig. 41). Then unplug the speed sensor cable from the vehicle wiring harness (Fig. 41).

(5) Remove bolt (Fig. 42) attaching speed sensor to steering knuckle. Then remove speed sensor head from steering knuckle

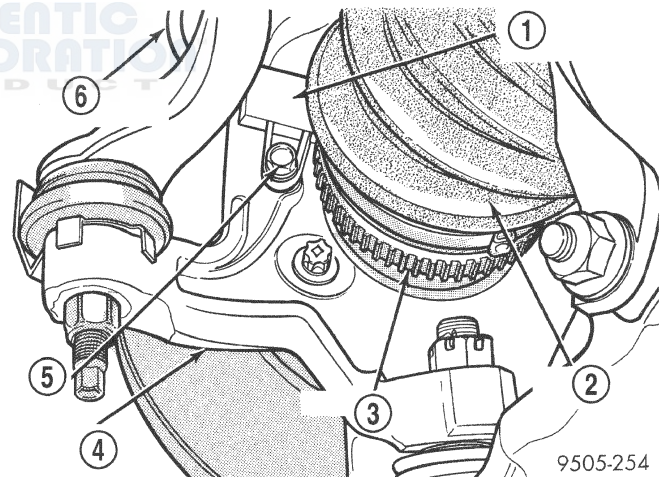
**CAUTION:** If speed sensor head locating pin has seized to the steering knuckle, do not attempt to remove speed sensor head by grasping with pliers and turning. This will damage the speed sensor head. Use only the following procedure.

(6) If speed sensor head can not be removed from steering knuckle by hand, the locating pin on the



**Fig. 41 Wheel Speed Sensor Connection To Vehicle Wiring Harness**

- 1 - FRONT SHOCK ABSORBER
- 2 - GROMMET RETAINING BRACKET
- 3 - WHEEL SPEED SENSOR CABLE
- 4 - SEALING GROMMET
- 5 - VEHICLE WIRING HARNESS
- 6 - INNER FENDER



**Fig. 42 Speed Sensor Head Attachment To Steering Knuckle**

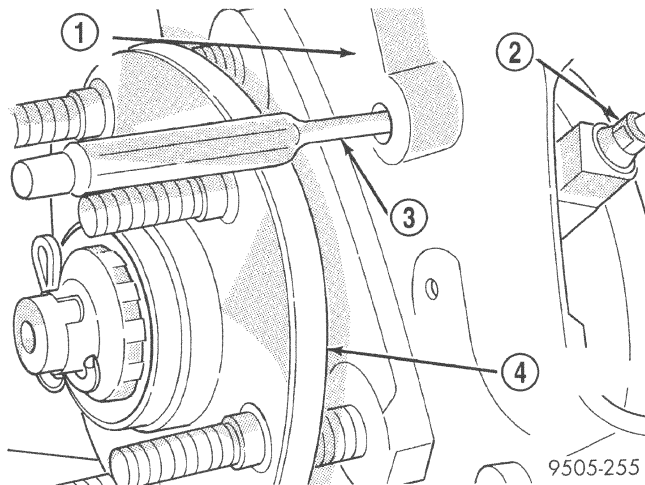
- 1 - SPEED SENSOR HEAD
- 2 - DRIVESHAFT
- 3 - TONE WHEEL
- 4 - STEERING KNUCKLE
- 5 - BOLT
- 6 - SPEED SENSOR CABLE

speed sensor head has seized to the steering knuckle do to corrosion. Remove speed sensor head from steering knuckle using the following procedure. Remove disc brake caliper from steering knuckle, and remove brake rotor from hub/bearing assembly. Then insert a pin punch through hole in front steering



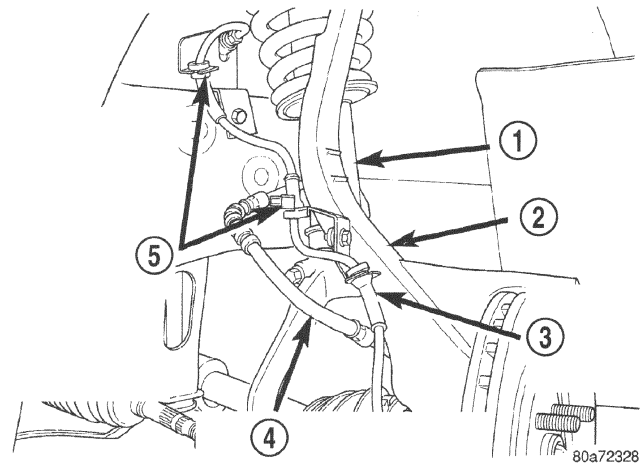
**REMOVAL AND INSTALLATION (Continued)**

knuckle (Fig. 43) and tap speed sensor head locating pin out of steering knuckle.



**Fig. 43 Speed Sensor Head Removal From Steering Knuckle**

- 1 - STEERING KNUCKLE
- 2 - SPEED SENSOR HEAD
- 3 - PIN PUNCH
- 4 - HUB/BEARING



**Fig. 44 Correct Front Wheel Speed Sensor Cable Routing**

- 1 - SHOCK ABSORBER
- 2 - STEERING KNUCKLE
- 3 - WHEEL SPEED SENSOR CABLE
- 4 - BRAKE FLEX HOSE
- 5 - WHEEL SPEED SENSOR CABLE MUST BE LOOPED TOWARD SHOCK ABSORBER BETWEEN THESE ROUTING BRACKETS.

**INSTALLATION**

**CAUTION:** Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

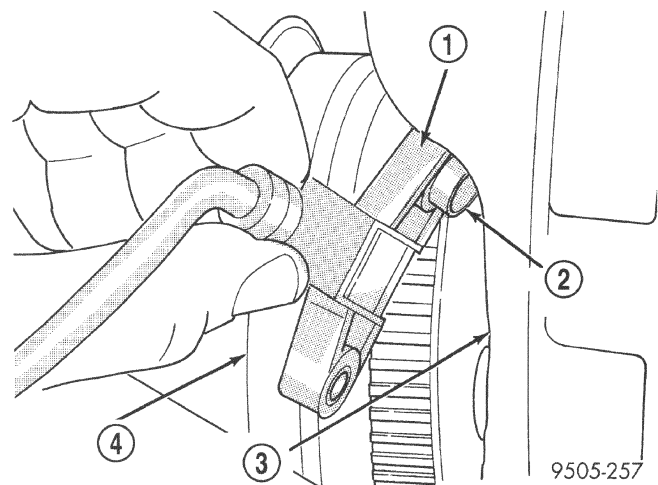
(1) Connect the wheel speed sensor cable connector to the vehicle wiring harness (Fig. 41).

(2) Install the speed sensor cable assembly grommet into the front inner fender (Fig. 41). Install speed sensor cable grommet retainer/routing bracket on the inner fender of the vehicle and install and securely tighten attaching bolt (Fig. 40).

**CAUTION:** When installing the wheel speed sensor cable routing bracket on the steering knuckle, (Fig. 40) the speed sensor cable must be looped toward the shock absorber as shown in (Fig. 44). If speed sensor cable is not routed in this direction it will rub against the tire or wheel, damaging the speed sensor cable.

(3) Install the speed sensor cable routing bracket on the steering knuckle. Install and tighten routing bracket mounting bolt to a torque of 12 N·m (105 in. lbs.).

(4) Install speed sensor head on steering knuckle (Fig. 45). When installing speed sensor head on steering knuckle, apply a small amount of grease on speed sensor locating pin (Fig. 45). Use Mopar, Multi-Purpose Grease or an equivalent on speed sensor head locating pin. Install the speed sensor head attaching screw and tighten to a torque of 6 N·m (55 in. lbs.).



**Fig. 45 Installing Speed Sensor Head In Steering Knuckle**

- 1 - SPEED SENSOR HEAD
- 2 - LOCATING PIN
- 3 - STEERING KNUCKLE
- 4 - DRIVESHAFT



**REMOVAL AND INSTALLATION (Continued)**

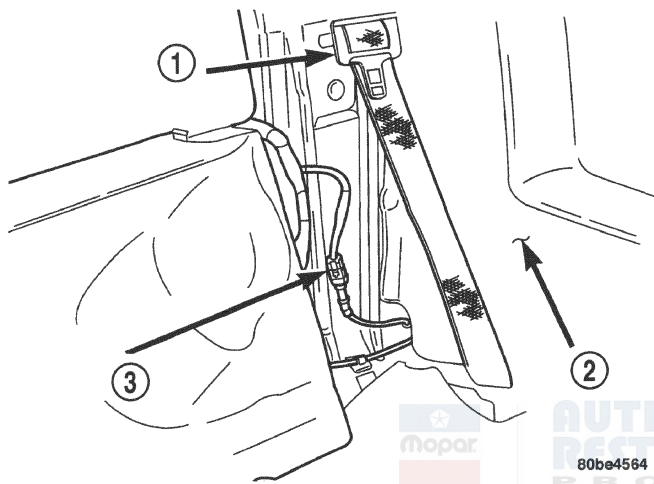
- (5) Install the wheel and tire assembly on vehicle.
- (6) Road test vehicle to ensure proper operation of the base and ABS systems.

**WHEEL SPEED SENSOR (REAR)**

This procedure is for the removal and installation of one of the two rear wheel speed sensors.

**REMOVAL**

- (1) Remove the rear seat cushion and back, then disconnect the wheel speed sensor cable connector from the vehicle wiring harness (Fig. 46).



**Fig. 46 Connection At Vehicle Wiring Harness**

- 1 - OUTER SEAT BELT
- 2 - QUARTER TRIM PANEL
- 3 - CONNECTOR

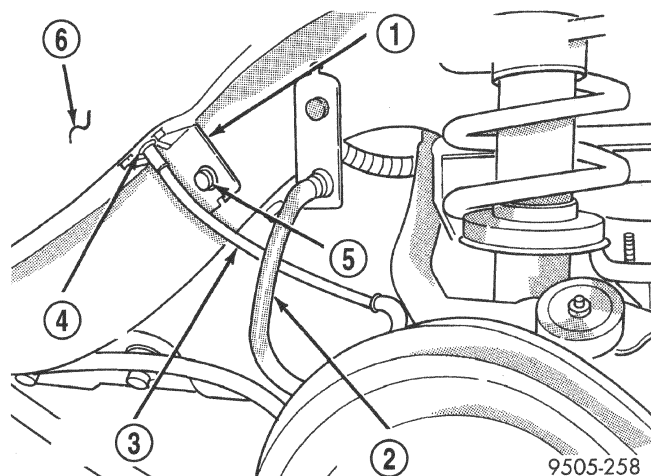
- (2) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

- (3) Remove the rear tire and wheel assembly from the vehicle.

- (4) Remove speed sensor cable sealing grommet retainer (Fig. 47) from the rear frame rail of the vehicle. Then remove speed sensor cable sealing grommet and cable from hole in body of vehicle.

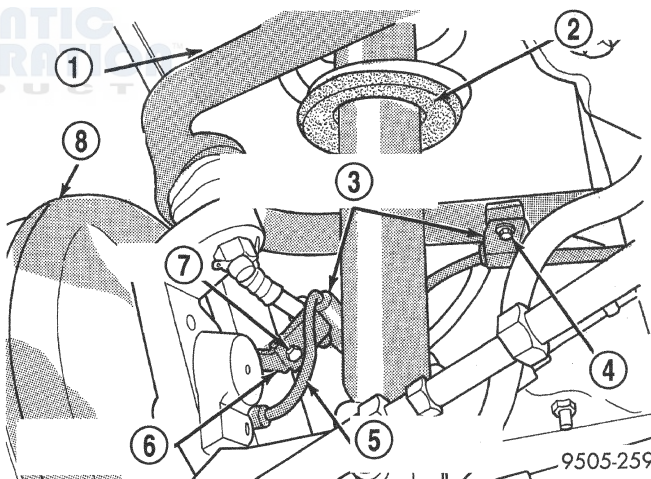
- (5) Remove speed sensor routing clips from the rear upper control arm and brake flex hose routing bracket (Fig. 48).

- (6) Remove the rear speed sensor from the rear brake support plate (Fig. 49).



**Fig. 47 Rear Speed Sensor Cable Attachment To Body**

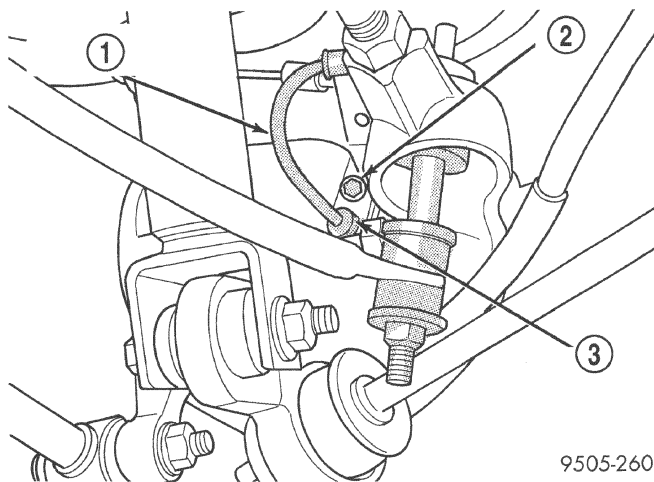
- 1 - SEALING GROMMET RETAINER
- 2 - BRAKE FLEX HOSE
- 3 - SPEED SENSOR CABLE
- 4 - SEALING GROMMET
- 5 - BOLT
- 6 - REAR INNER FENDER



**Fig. 48 Speed Sensor Cable Attachment To Rear Suspension**

- 1 - UPPER CONTROL ARM
- 2 - SHOCK ABSORBER
- 3 - SPEED SENSOR CABLE ROUTING CLIPS
- 4 - BOLT
- 5 - SPEED SENSOR CABLE
- 6 - BRAKE FLEX HOSE BRACKET
- 7 - BOLT
- 8 - BRAKE DRUM

## REMOVAL AND INSTALLATION (Continued)



**Fig. 49 Rear Speed Sensor Head Attachment To Brake Support Plate**

- 1 - SPEED SENSOR CABLE
- 2 - BOLT
- 3 - SPEED SENSOR HEAD

## INSTALLATION

**CAUTION:** Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

(1) Install speed sensor head into brake support plate (Fig. 49).

(2) Install wheel speed sensor attaching bolt (Fig. 49). Tighten the speed sensor head attaching bolt to 8 N·m (75 in. lbs.).

(3) Install speed sensor cable routing clips (Fig. 48) on the brake flex hose bracket and the bracket on the upper control arm. Install and securely tighten the routing clip attaching bolts.

(4) Install connector end of speed sensor cable through hole in inner fender and into trunk of vehicle.

(5) Install speed control sealing grommet into hole in inner fender. Install the sealing grommet retainer and attaching bolt (Fig. 47) on rear frame rail. Securely tighten retainer attaching bolt.

(6) Install the tire and wheel assembly on vehicle.

(7) Lower vehicle.

(8) Reconnect the wheel speed sensor cable connector to the vehicle wiring harness (Fig. 46), install any removed foam tape back around connectors, then reinstall the rear seat back and cushion.

(9) Road test vehicle to ensure proper operation of the base and ABS systems.

## DISASSEMBLY AND ASSEMBLY

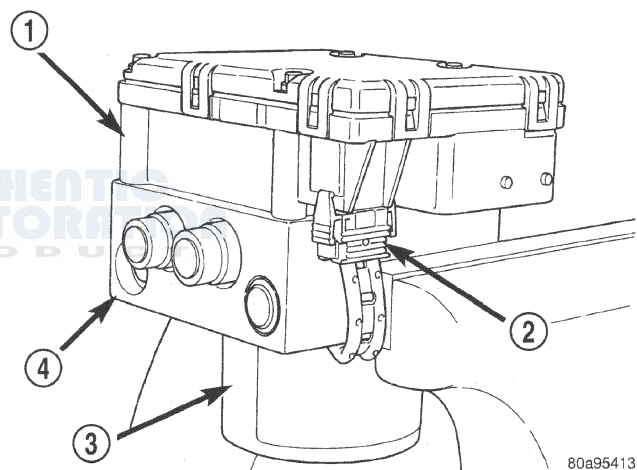
## INTEGRATED CONTROL UNIT

## REMOVAL

**NOTE:** To replace the hydraulic control unit (HCU) or the controller antilock brake (CAB) on this vehicle, the entire integrated control unit (ICU) needs to be removed from the vehicle. The CAB can then be separated from the HCU. Do not attempt to replace the CAB with the ICU mounted in the vehicle.

(1) Remove the ICU from the vehicle. Refer INTEGRATED CONTROL UNIT in the REMOVAL AND INSTALLATION section in this section of the service manual.

(2) Disconnect the pump/motor wiring harness (Fig. 50) from the CAB.



**Fig. 50 Pump/Motor To CAB Wiring Harness**

- 1 - CAB
- 2 - PUMP MOTOR WIRING HARNESS
- 3 - PUMP MOTOR
- 4 - HCU VALVE BLOCK

(3) Remove the 4 bolts (Fig. 51) attaching the CAB to the HCU.

(4) Remove the CAB from the HCU (Fig. 52).

## INSTALLATION

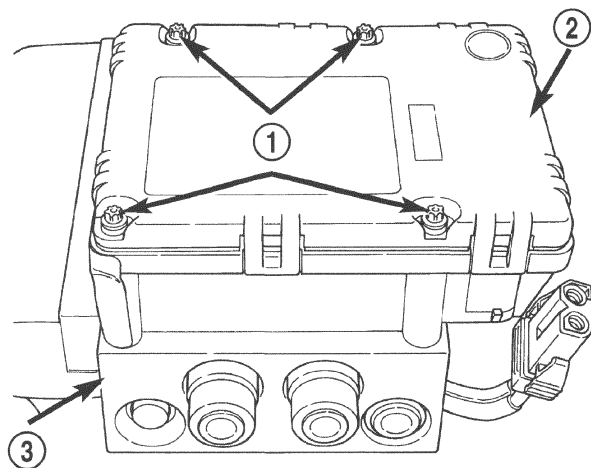
(1) Install the CAB (Fig. 52) on the HCU.

(2) Install the 4 bolts mounting the CAB (Fig. 51) to the HCU. Tighten the CAB mounting bolts to a torque of 2 N·m (17 in. lbs.).

(3) Plug the pump/motor wiring harness into the CAB (Fig. 50).

(4) Install the ICU in the vehicle.

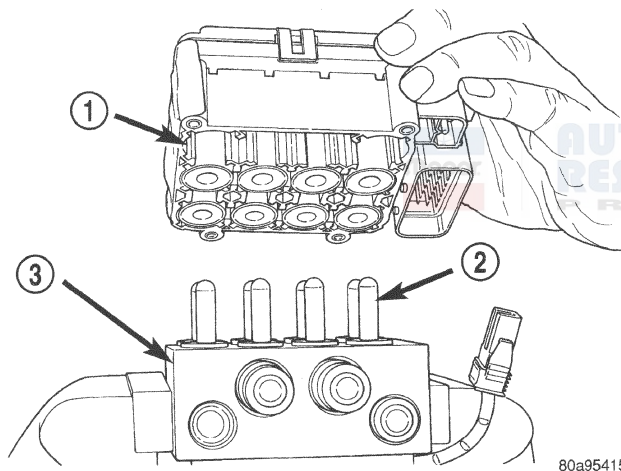
(5) Bleed the base and ABS hydraulic systems. Refer to ANTILOCK BRAKE SYSTEM BLEEDING in this section of this service manual group.

**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 51 CAB Attaching Bolts**

- 1 - MOUNTING BOLTS  
2 - CAB  
3 - HCU VALVE BLOCK



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**Fig. 52 Remove/Install CAB**

- 1 - CAB  
2 - HCU VALVES  
3 - HCU VALVE BLOCK

(6) Road test the vehicle to ensure proper operation of the base brakes and ABS.

**SPECIFICATIONS****tone wheel runout****FRONT TONE WHEEL:**

Maximum Runout . . . . . 0.25 mm (0.009 in.)

**REAR TONE WHEEL:**

Maximum Runout . . . . . 0.25 mm (0.009 in.)

**WHEEL SPEED SENSOR-TO-TONE WHEEL CLEARANCE****FRONT WHEEL:**

Minimum Clearance . . . . . 0.17 mm (0.007 in.)

Maximum Clearance . . . . . 1.80 mm (0.072 in.)

**REAR WHEEL:**

Minimum Clearance . . . . . 0.37 mm (0.015 in.)

Maximum Clearance . . . . . 1.50 mm (0.059 in.)

**WHEEL SPEED SENSOR RESISTANCE****ALL:**

Allowable Resistance . . . . . 2160 - 2640 ohms

**BRAKE FASTENER TORQUE SPECIFICATIONS****DESCRIPTION****TORQUE****MASTER CYLINDER:**

To Vacuum Booster Mounting Nut . . . . . 28 N·m  
(250 in. lbs.)

**BRAKE BOOSTER:**

To Dash Panel Mounting Nuts . . . . . 28 N·m  
(250 in. lbs.)

**BRAKE TUBES:**

Tube Nuts . . . . . 17 N·m (145 in. lbs.)

**BRAKE HOSE:**

Caliper Banjo Bolt . . . . . 48 N·m (35 ft. lbs.)

Intermediate Bracket . . . . . 23 N·m (17 ft. lbs.)

**DISC BRAKE CALIPER:**

Guide Pin Bolts . . . . . 22 N·m (192 in. lbs.)

Bleeder Screw . . . . . 20 N·m (15 ft. lbs.)

**REAR WHEEL CYLINDER:**

To Support Plate Mounting Bolts . . . . . 11 N·m  
(97 in. lbs.)

Bleeder Screw . . . . . 8 N·m (75 in. lbs.)

**BRAKE SUPPORT PLATE:**

To Axle Mounting Bolts . . . . . 63 N·m (46 ft. lbs.)

**INTEGRATED CONTROL UNIT (HCU AND CAB):**

To Mounting Bracket Bolts . . . . . 11 N·m (97 in. lbs.)

Bracket To Crossmember Mounting Bolts . . . . . 28 N·m  
(250 in. lbs.)

CAB To HCU Mounting Bolts . . . . . 2 N·m (17 in. lbs.)

**PARKING BRAKE:**

Lever Mounting Nuts . . . . . 28 N·m (250 in. lbs.)

**REAR HUB AND BEARING:**

To Knuckle Retaining Nut . . . . . 250 N·m (185 ft. lbs.)

Stud Lug Nut . . . . . 109-150 N·m (80-110 ft. lbs.)



# COOLING SYSTEM

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## DESCRIPTION AND OPERATION

### COOLING SYSTEM

#### DESCRIPTION

The cooling system consists of an engine cooling module, thermostat, coolant, a water pump to circulate the coolant. The engine cooling module may consist of a radiator, electric fan motor, shroud, radiator pressure cap, coolant reserve system, transmission oil cooler and lines, hoses, clamps, and air conditioning condenser.

#### OPERATION

The primary purpose of a cooling system is to maintain engine temperature in a range that will provide satisfactory engine performance and emission levels under all expected driving conditions. It also provides hot water (coolant) for heater performance and cooling for automatic transmission oil. It does this by transferring heat from engine metal to coolant, moving this heated coolant to the radiator, and then transferring this heat to the ambient air.

The coolant flow circuits for the 2.5L engine is shown in (Fig. 1).

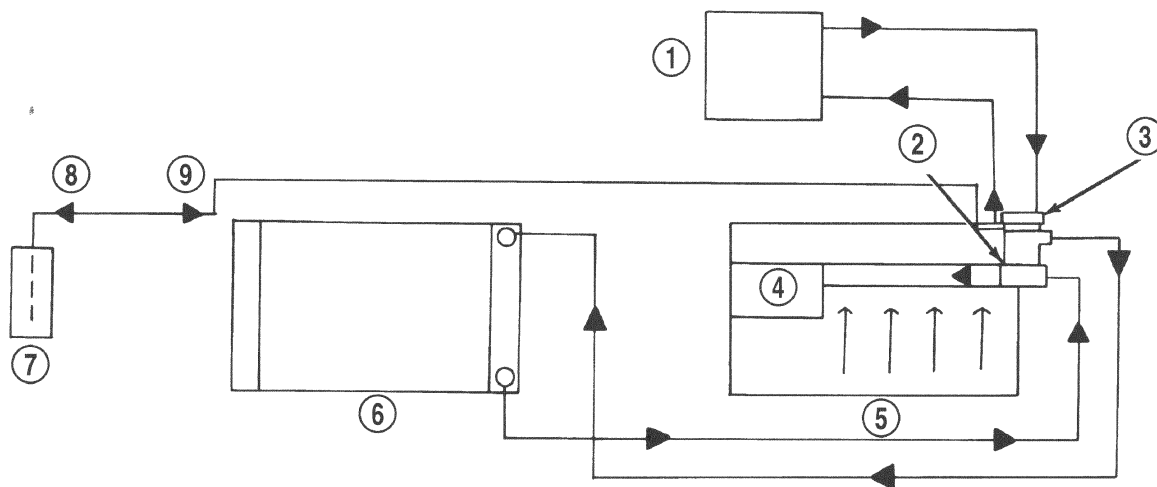
### COOLANT

#### DESCRIPTION

##### ETHYLENE-GLYCOL MIXTURES

**CAUTION:** Richer antifreeze mixtures cannot be measured with normal field equipment and can cause problems associated with 100 percent ethylene-glycol.

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.



9507-97

**Fig. 1 Cooling System Operation—2.5L Engine**

- |                        |                                  |
|------------------------|----------------------------------|
| 1 - HEATER             | 6 - RADIATOR                     |
| 2 - THERMOSTAT HOUSING | 7 - COOLANT RECOVERY SYSTEM TANK |
| 3 - PRESSURE CAP       | 8 - HEAT UP                      |
| 4 - WATER PUMP         | 9 - COOL DOWN                    |
| 5 - ENGINE             |                                  |

## DESCRIPTION AND OPERATION (Continued)

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 deg. C (300 deg. F). This temperature is hot enough to melt plastic and soften solder. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at 22 deg. C (-8 deg. F).

### PROPYLENE-GLYCOL MIXTURES

It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125 deg. C (257 deg. F) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up on a cooling system designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/ethylene-glycol Mixtures can cause the destabilization of various corrosion inhibitors, causing damage to the various cooling system components. Also, once ethylene-glycol and propylene-glycol based coolants are mixed in the vehicle, conventional methods of determining freeze point will not be accurate. Both the refractive index and specific gravity differ between ethylene glycol and propylene glycol.

## OPERATION

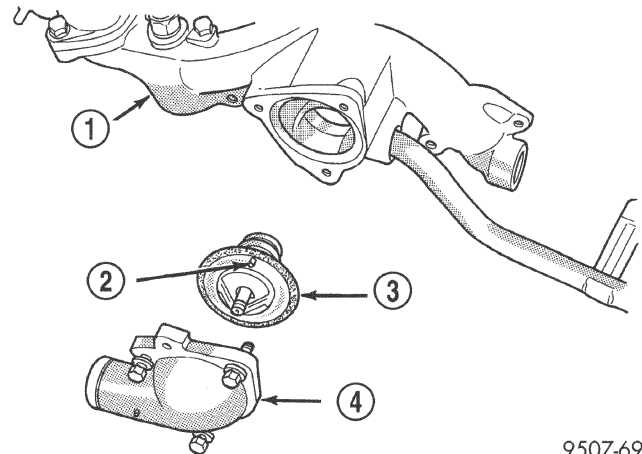
### ETHYLENE-GLYCOL MIXTURES

Coolant flows through the engine block absorbing the heat from the engine, then flows to the radiator where the cooling fins in the radiator transfers the heat from the coolant to the atmosphere. During cold weather the ethylene-glycol coolant prevents water present in the cooling system from freezing within temperatures indicated by mixture ratio of coolant to water.

## ENGINE THERMOSTAT—2.5L ENGINE

### DESCRIPTION

The 2.5L engine thermostat is located in a thermostat housing, located below the throttle body. This thermostat has an air bleed valve, located in the thermostat flange (Fig. 2).



9507-69

**Fig. 2 Thermostat, Housing and Inlet Elbow—2.5L Engine**

- 1 - THERMOSTAT HOUSING
- 2 - VENT INSTALLED UPWARD
- 3 - THERMOSTAT
- 4 - COOLANT INLET ELBOW

## OPERATION

The engine cooling thermostat is a wax pellet driven, reverse poppet choke type. It is designed to provide the fastest warm up possible by preventing leakage through it and to guarantee a minimum engine operating temperature of 88 to 93°C (192 to 199°F). The thermostat also will automatically reach wide open so it will not restrict flow to the radiator as temperature of the coolant rises in hot weather to around 104°C (220°F). Above this temperature the coolant temperature is controlled by the radiator, fan, and ambient temperature, not the thermostat.

The thermostat is operated by a wax filled container (pellet) which is sealed. When heated coolant reaches a predetermined temperature, the wax expands enough to overcome the closing spring and water pump pressure, which forces the valve to open.

Coolant leakage into the wax pellet will cause a thermostat to fail open. Do not attempt to free-up a stuck open thermostat.

## COOLANT RECOVERY SYSTEM

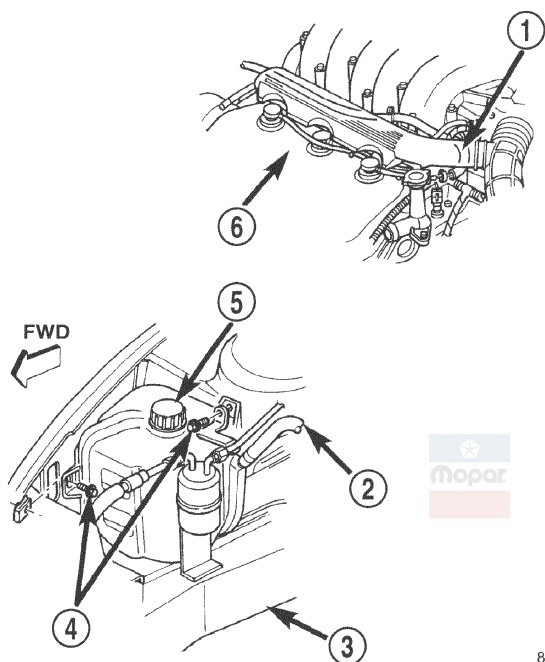
### DESCRIPTION

The coolant recovery system consist of a container and hose that is connected to the cooling system.



**DESCRIPTION AND OPERATION (Continued)****OPERATION**

This system works in conjunction with the pressure cap to utilize thermal expansion and contraction of the coolant to keep the coolant free of trapped air. It provides a volume for expansion and contraction, provides a convenient and safe method for checking coolant level, and adjusting level at atmospheric pressure without removing the pressure cap. It also provides some reserve coolant to cover minor leaks and evaporation or boiling losses. All vehicles are equipped with this system (Fig. 3).

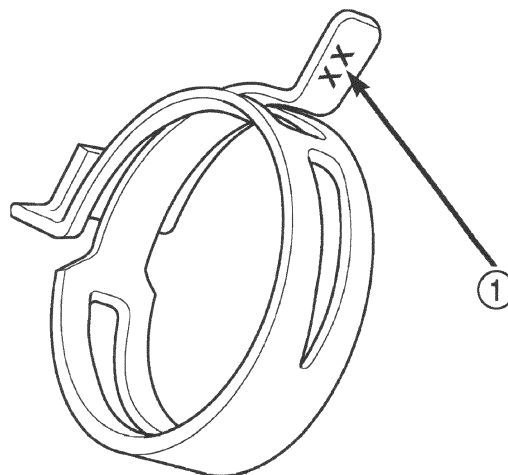
**Fig. 3 Coolant Recovery System**

- 1 - TO CRS BOTTLE
- 2 - TO ENGINE
- 3 - RIGHT FRAME RAIL
- 4 - SCREWS (2) 4.6 N-m (40 in. lbs.)
- 5 - COOLANT RECOVERY SYSTEM (CRS) BOTTLE
- 6 - 2.5L ENGINE

**HOSE CLAMPS****DESCRIPTION**

The cooling system utilizes both worm drive and spring type hose clamps. If a spring type clamp replacement is necessary, replace with the original Mopar® equipment spring type clamp.

**CAUTION:** A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only a original equipment clamp with matching number or letter (Fig. 4).



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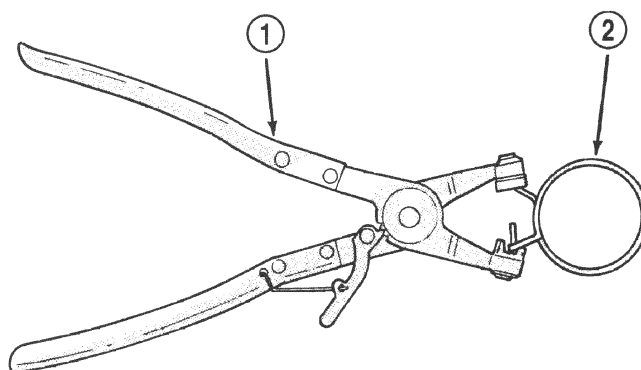
**Fig. 4 Spring Clamp Size Location**

- 1 - SPRING CLAMP SIZE LOCATION

**OPERATION**

The worm type hose clamp uses a specified torque value to maintain proper tension on a hose connection.

The spring type hose clamp applies constant tension on a hose connection. To remove a spring type hose clamp, use Special Tool 6094 or equivalent, constant tension clamp pliers (Fig. 5) to compress the hose clamp.



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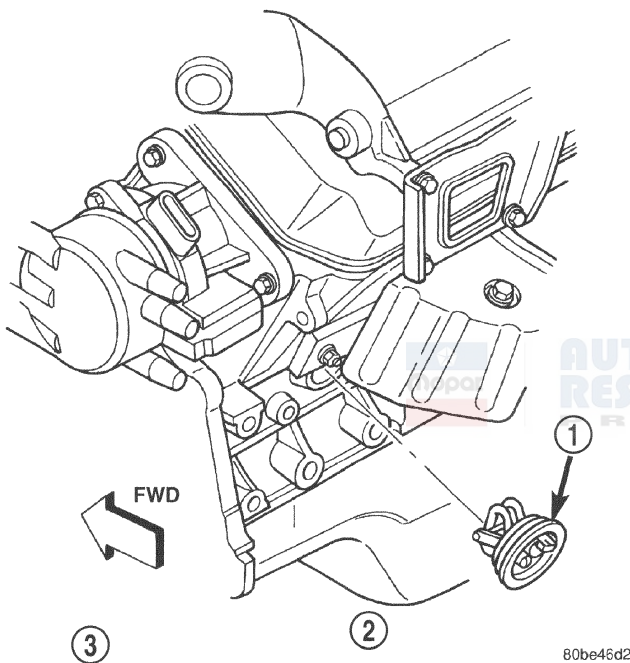
**Fig. 5 Hose Clamp Tool**

- 1 - HOSE CLAMP TOOL 6094
- 2 - HOSE CLAMP

**DESCRIPTION AND OPERATION (Continued)****ENGINE BLOCK HEATER****DESCRIPTION**

The block heater is operated by ordinary house current (110 Volt A. C.) through a power cord and connector behind the radiator grille. The heater is mounted in a core hole (in place of a core hole plug) in the engine block, with the heating element immersed in coolant (Fig. 6).

**CAUTION:** The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds and become damaged.

**Fig. 6 Engine Block Heater**

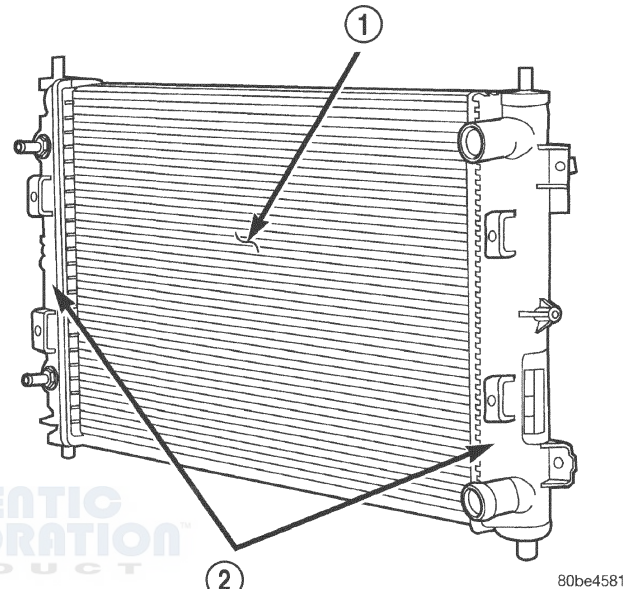
- 1 - BLOCK HEATER
- 2 - 2.5L ENGINE
- 3 - LEFT REAR SIDE VIEW

**OPERATION**

The block heater element is submerged in the cooling system's coolant. When electrical power (110 volt A. C.) is applied to the element, it creates heat. This heat is transferred to the engine coolant. This provides easier engine starting and faster warm-up when vehicle is operated in areas having extremely low temperatures.

**RADIATOR****DESCRIPTION**

The radiator is a cross flow type (horizontal tubes) with design features that provide greater strength as well as sufficient heat transfer capabilities to keep the engine within operating temperatures. The radiator cooling tubes are made of aluminum and the side tanks are plastic (Fig. 7).

**Fig. 7 Radiator**

- 1 - COOLING TUBES
- 2 - TANKS

**OPERATION**

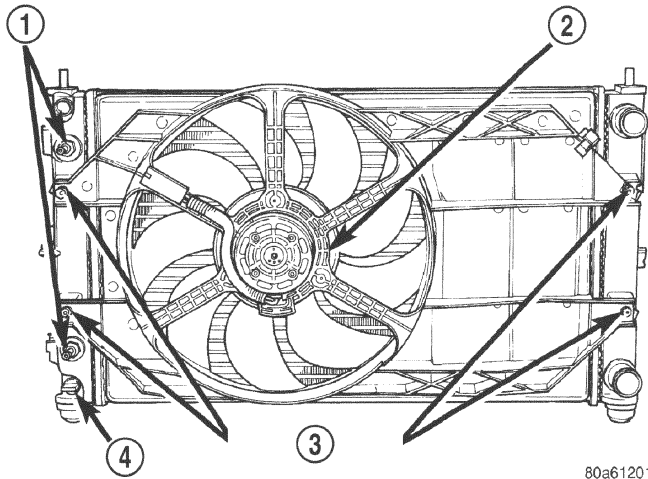
The radiator functions as a heat exchanger, using air flow across the exterior of the radiator tubes. This heat is then transferred from the coolant and into the passing air.

**COOLING SYSTEM FAN****DESCRIPTION**

The radiator has a single cooling fan, with a two speed electric motor (Fig. 8). The fan module includes a motor, shroud, and a fan. The fan module is fastened to the radiator by bolts.

**DESCRIPTION AND OPERATION (Continued)****OPERATION**

The fan is controlled by the Powertrain Control Module (PCM) which energizes the fan relay. The electric motor drives the cooling fan to produce air flow across the radiator fins.

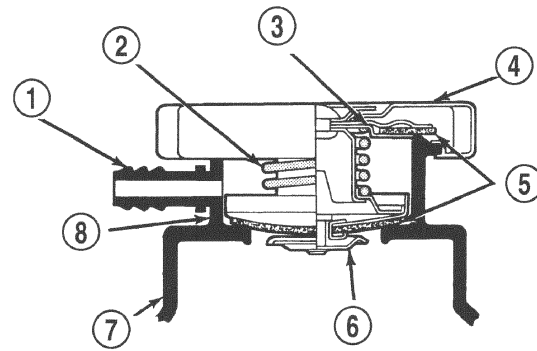
**Fig. 8 Cooling Fan Module**

- 1 - TRANSMISSION OIL COOLER
- 2 - SINGLE FAN
- 3 - FAN MODULE FASTENERS
- 4 - DRAINCOCK

**COOLING SYSTEM PRESSURE CAP****DESCRIPTION**

The cooling system is equipped with a pressure cap that releases built up pressure, maintaining a range of 97-124 kPa (14-18 psi).

There is also a vent valve in the center of the cap. This valve also opens when coolant is cooling and contracting, allowing coolant to return to radiator from coolant reserve system tank by vacuum through connecting hose. **If valve is stuck shut, the radiator hoses will be collapsed on cool down. Clean the vent valve (Fig. 9) to ensure proper sealing when boiling point is reached.**



9407-12

**Fig. 9 Cooling System Pressure Cap**

- 1 - OVERFLOW NIPPLE
- 2 - MAIN SPRING
- 3 - GASKET RETAINER
- 4 - STAINLESS-STEEL SWIVEL TOP
- 5 - RUBBER SEALS
- 6 - VENT VALVE
- 7 - THERMOSTAT HOUSING/ENGINE OUTLET CONNECTOR
- 8 - FILLER NECK

**OPERATION**

The pressure cap allows the cooling system to operate at higher than atmospheric pressure. The higher pressure raises the coolant boiling point thus, allowing increased radiator cooling capacity.

The gasket in the cap seals the filler neck, so that vacuum can be maintained, allowing coolant to be drawn back into the radiator from the reserve tank.

**ACCESSORY DRIVE BELTS****DESCRIPTION**

The accessory drive consist of two Poly-V type belts (Fig. 10). One belt drives the power steering pump, the other drives the generator and air conditioning compressor. Both belts are manually tensioned.

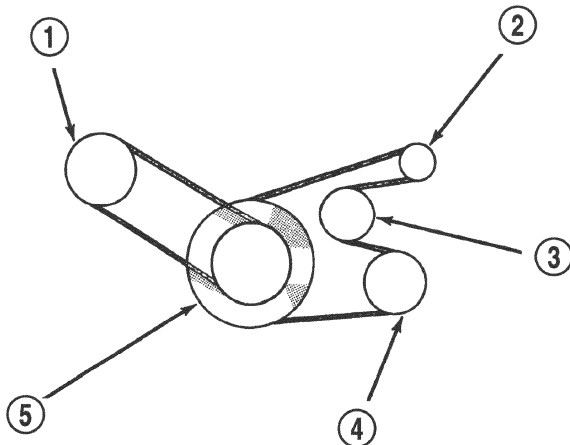
**OPERATION**

The accessory drive belts are the link between the engine crankshaft and the engine driven accessories.

**TRANSMISSION OIL COOLER****DESCRIPTION**

The automatic transmission oil cooler is an internal oil to coolant type, mounted inside the radiator right tank (Fig. 11). Rubber hoses and steel lines connect the oil cooler to the automatic transmission.



**DESCRIPTION AND OPERATION (Continued)**

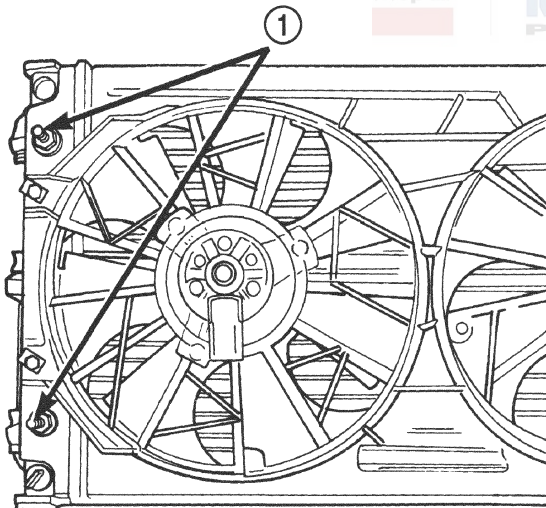
9507-85

**Fig. 10 Accessory Drive Belt System**

- 1 - POWER STEERING PUMP
- 2 - GENERATOR
- 3 - IDLER
- 4 - AIR CONDITIONING COMPRESSOR
- 5 - CRANKSHAFT DAMPER

**OPERATION**

As oil flows through the cooler, heat from the oil is transferred to the coolant.



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**Fig. 11 Transmission Oil Cooler—Typical**

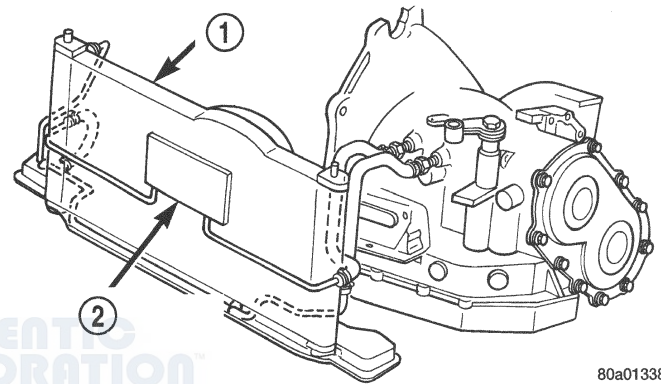
- 1 - AUTOMATIC TRANSMISSION OIL COOLER NIPPLES

**TRANSMISSION OIL COOLER EXTERNAL****DESCRIPTION**

An external oil-to-air type automatic transmission oil cooler is mounted ahead of the cooling module (Fig. 12). This style of cooler uses steel tubes and rubber oil lines to feed oil from the internal (in radiator tank) cooler to the external cooler and then to the automatic transmission.

**OPERATION**

The oil flows from the internal (in radiator tank) to the external oil-to-air cooler. As air flows across the cooling fins, heat is then transferred to the air.



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**Fig. 12 External Transmission Oil Cooler**

- 1 - COOLING MODULE
- 2 - TRANSMISSION AUXILIARY OIL COOLER

## DIAGNOSIS AND TESTING

### COOLING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
TEMPERATURE GAUGE READS LOW	<ol style="list-style-type: none"> <li>1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open engine thermostat?</li> <li>2. Is the temperature gauge (if equipped) connected to the temperature gauge coolant sensor on the engine?</li> <li>3. Is the temperature gauge (if equipped) operating OK?</li> <li>4. Coolant level low during cold ambient temperature, accompanied by poor heater performance.</li> </ol>	<ol style="list-style-type: none"> <li>1. Refer to On Board Diagnostic in Group 25. Replace thermostat, if necessary. If a (DTC) has not been set, the problem may be with the temperature gauge.</li> <li>2. Check the connector at the engine coolant sensor. Refer to Group 8E. Repair as necessary.</li> <li>3. Check Gauge operation. Refer to Group 8E. Repair as necessary.</li> <li>4. Check coolant level in the coolant recovery/reserve container and the radiator. Inspect the system for leaks. Repair as necessary. Refer to WARNINGS in this section before removing pressure cap.</li> </ol>
TEMPERATURE GAUGE READS HIGH OR ENGINE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST FROM SYSTEM.	<ol style="list-style-type: none"> <li>1. Trailer being towed, a steep hill being climbed, vehicle being operated in slow moving traffic, or engine idling during high ambient (outside) temperatures with air conditioning on. High altitudes Could aggravate these conditions.</li> <li>2. Is temperature gauge (if equipped) reading correctly?</li> <li>3. Is temperature warning lamp (if equipped) illuminating unnecessarily?</li> <li>4. Coolant low in recovery/reserve container and radiator?</li> <li>5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following step 6.</li> </ol>	<ol style="list-style-type: none"> <li>1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and drive the vehicle without any of the previous conditions. Observe the temperature gauge the gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause of the overheating and repair. Refer to POSSIBLE CAUSES in this section.</li> <li>2. Check gauge. Refer to Group 8E. Repair as necessary.</li> <li>3. Check warning lamp operation. Refer to Group 8E. Repair as necessary.</li> <li>4. Check for coolant leaks and repair as necessary. Refer to Checking Cooling System for Leaks in this section.</li> <li>5. Tighten cap.</li> </ol>

**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSE	CORRECTION
	6. Poor seals at radiator cap.	6. (a) Check condition of cap and cap seals. Refer to Radiator cap Inspection. Replace cap if necessary. (b) Check condition of filler neck. If neck is bent or damaged, replace neck.
	7. Coolant level low in radiator, but not in coolant recovery/reserve container. This indicates the radiator is not drawing coolant from the coolant recovery/reserve container as the engine cools. As the engine cools, a vacuum is formed inside the cooling system. If the radiator cap seals are defective, or the cooling system has a leak, a vacuum cannot be formed.	7. (a) Check condition of radiator cap and cap seals. Replace cap if necessary. (b) Check condition of filler neck. Replace if damaged. (c) Check condition of hose from filler neck to coolant container. It should be tight at both ends without any kinks or tears. Replace hose as necessary. (d) Check coolant recovery/reserve container and hose for blockage. Repair as necessary.
	8. Freeze point of coolant not correct. Mixture ratio may be too rich.	8. Check coolant concentration. Refer to Coolant Concentration Testing in this section. Adjust glycol-to-water ratio as required.
	9. Coolant not flowing through system.	9. Check for coolant flow at filler neck with some coolant removed, engine warm, and thermostat open. Coolant should be observed flowing through filler neck. If flow is not observed, determine reason for lack of flow and repair as necessary.
	10. Radiator or A/C condenser fins are dirty or clogged.	10. Clean obstruction from fins.
	11. Radiator core is plugged or corroded.	11. Replace or re-core radiator.
	12. Fuel or ignition system problems.	12. Refer to Fuel and Ignition System groups for diagnosis. Also refer to the appropriate Powertrain Diagnostic Procedure manual.
	13. Dragging Brakes.	13. Inspect brake system and repair as necessary. Refer to Group 5, Brakes for diagnosis.
	14 Bug screen or other aftermarket accessory is being used causing reduced air flow.	14. Remove bug screen or accessory.
	15. Thermostat partially or completely closed.	15. Check thermostat operation and replace as necessary. Refer to thermostat in this section for procedure.



**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSE	CORRECTION
	<p>16. Electric cooling fan not operating properly.</p> <p>17. Cylinder head gasket leaking.</p> <p>18. Heater core leaking.</p>	<p>16. Check electric fan operation and repair as necessary.</p> <p>17. Check cylinder head gasket for leaks. Refer to testing cooling system for leaks. For repairs, refer to Group 9, Engine.</p> <p>18. Check heater core for leaks. Refer to Group 24, Heating and Air Conditioning and repair as necessary.</p>
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC)	<p>1. The gauge may cycle up and down. This is due to the cycling of the electric radiator fan.</p> <p>2. During cold weather operation with the heater blower in the high position, the gauge reading may drop slightly.</p> <p>3. Temperature gauge or engine mounted gauge sensor is defective or shorted.</p> <p>4. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running).</p> <p>5. Gauge reading high after restarting a warmed-up (hot) engine.</p> <p>6. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).</p> <p>7. Cylinder head gasket leaking allowing exhaust gas to enter cooling system. This will cause thermostat to open late.</p> <p>8. Water pump impeller loose on shaft.</p> <p>9. Loose drive belt (water pump slipping).</p>	<p>1. A normal condition. No correction is necessary. If gauge cycling is going into the hot zone, check electric fan operation and repair as necessary. Refer to procedure in this section.</p> <p>2. A normal condition. No correction is necessary.</p> <p>3. Check operation of gauge and repair as necessary. Refer to Group 8E, Instrument Panel and Gauges.</p> <p>4. A normal condition. No correction is necessary. The gauge should return to normal range after vehicle is driven.</p> <p>5. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.</p> <p>6. Check and correct coolant leaks. Refer to Testing Cooling System For Leaks in the section.</p> <p>7. (a) Check for cylinder head gasket leaks using Tool C-3685-A Block Leak Tester or the equivalent. Repair as necessary. (b) Check for coolant in the engine oil. Inspect for white steam emitting from exhaust system. Repair as necessary.</p> <p>8. Check water pump and replace as necessary. Refer to Water Pump in this section.</p> <p>9. Check drive belt and correct as necessary.</p>

**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSE	CORRECTION
	10. Air leak on the suction side of water pump allows air to build up in cooling system. This will cause the thermostat to open late.	10. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT FLOWING INTO RECOVERY CONTAINER. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL, BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN RECOVERY CONTAINER.	1. Pressure relief valve in radiator cap is defective.	1. Check condition of radiator cap and seals. Refer to Radiator Cap in this section. Replace as necessary.
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE IS READING HIGH OR HOT.	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test and repair as necessary. Refer to Testing Cooling System For Leaks in this section.
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH.	1. Engine overheating.  2. Freeze point of coolant not correct.	1. Check reason for overheating and repair as necessary.  2. Check the freeze point of the coolant. Refer to Coolant Concentration Testing in this section. Adjust glycol-to-water ratio as required.
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant recovery/reserve container system.	1. (a) Radiator cap relief valve stuck. Refer to Radiator Cap in this section. Replace as necessary.  (b) Hose between coolant recovery/reserve container and radiator is kinked. Repair as necessary.  (c) Vent at coolant recovery/reserve container is plugged. Clean vent and repair as necessary.  (d) Recovery/reserve container is internally blocked or plugged. Check for blockage and repair as necessary.
ELECTRIC RADIATOR FAN OPERATES ALL THE TIME.	1. Fan relay, powertrain control module (PCM) or engine coolant temperature sensor defective.  2. Check for low coolant level.	1. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.  2. Repair as necessary.

**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSE	CORRECTION
ELECTRIC RADIATOR FAN WILL NOT OPERATE. GAUGE READING HIGH OR HOT	<ol style="list-style-type: none"> <li>1. Fan motor defective.</li> <li>2. Fan relay, powertrain control module (PCM) or engine coolant temperature sensor defective.</li> <li>3. Blown fuse in power distribution center (PDC).</li> </ol>	<ol style="list-style-type: none"> <li>1. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.</li> <li>2. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.</li> <li>3. Determine reason for blown fuse and repair as necessary.</li> </ol>
NOISY FAN	<ol style="list-style-type: none"> <li>1. Fan blade loose.</li> <li>2. Fan blade striking a surrounding object.</li> <li>3. Air obstructions at radiator or A/C condenser.</li> <li>4. Electric fan motor defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace fan blade assembly. Refer to Cooling System Fan in this section.</li> <li>2. Locate point of fan blade contact and repair as necessary.</li> <li>3. Remove obstructions and/or clean debris from radiator and/or A/C condenser.</li> <li>4. Refer to procedure in this section.</li> </ol>
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	<ol style="list-style-type: none"> <li>1. Radiator and/or air conditioning condenser is restricted, obstructed or dirty.</li> <li>2. Electric radiator fan not operating when A/C is on.</li> <li>3. Engine is overheating (heat may be transferred from radiator to A/C condenser). High underhood temperature due to engine overheating may also transfer heat to A/C components.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove restriction and/or clean as necessary.</li> <li>2. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.</li> <li>3. Correct overheating condition. Refer to this section.</li> </ol>



**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSE	CORRECTION
INADEQUATE HEATER PERFORMANCE.	<ol style="list-style-type: none"> <li>1. Has a diagnostic trouble code (DTC) been set?</li> <li>2. Coolant level low.</li> <li>3. Obstructions in heater hose fittings at engine.</li> <li>4. Heater hose kinked.</li> <li>5. Water pump is not pumping coolant to heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch. The water pump drive belt may be slipping causing poor water pump operation.</li> </ol>	<ol style="list-style-type: none"> <li>1. Refer to On-Board Diagnostic in Group 25, Emission Control Systems.</li> <li>2. Refer to testing cooling system for leaks in this section. Repair as necessary.</li> <li>3. Remove heater hoses at both ends and check for obstructions. Repair as necessary.</li> <li>4. Locate kinked area and repair as necessary.</li> <li>5. Refer to water pump in this section. Repair as necessary.</li> </ol>
HEAT ODOR	<ol style="list-style-type: none"> <li>1. Various heat shields are used at certain driveline components. One or more of these shields may be missing.</li> <li>2. Is temperature gauge reading above the normal range?</li> <li>3. Is cooling fan operating correctly?</li> <li>4. Has undercoating been applied to any unnecessary component.</li> <li>5. Engine may be running rich causing the catalytic converter to overheat.</li> </ol>	<ol style="list-style-type: none"> <li>1. Locate missing shields and replace or repair as necessary.</li> <li>2. Refer to the previous Temperature Gauge Reads High in these Diagnostic Charts. Repair as necessary.</li> <li>3. Refer to Cooling System Fan in this section for diagnosis. Repair as necessary.</li> <li>4. Clean undercoating as necessary.</li> <li>5. Refer to appropriate Powertrain Diagnostic Procedures manual for operation of the DRB scan tool. Repair as necessary.</li> </ol>
POOR DRIVEABILITY (THERMOSTAT POSSIBLY STUCK OPEN). GAUGE MAY BE READING LOW	<ol style="list-style-type: none"> <li>1. For proper driveability, good vehicle emissions and for preventing build-up of engine oil sludge, the thermostat must be operating properly. Has a diagnostic trouble code (DTC ) been set?</li> </ol>	<ol style="list-style-type: none"> <li>1. Refer to On-Board Diagnostics in Group 25, Emission Control Systems. DTC's may also be check using the DRB scan tool. Refer to the proper Powertrain Diagnostic Procedure manual for checking the thermostat if necessary.</li> </ol>

**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSE	CORRECTION
STEAM IS COMING FROM FRONT OF VEHICLE NEAR GRILL AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP, RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE.	1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contact the hot radiator, steam may be emitted. This usually occurs in cold weather with no fan or airflow to blow it away.	1. Occasional steam emitting from this area is normal. No repair is necessary.
COOLANT COLOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. Check the freeze point of the coolant. Refer to Coolant Concentration Testing in this section for procedure. Adjust the glycol-to-water ratio as required.
COOLANT LEVEL CHANGES IN COOLANT RECOVERY/RESERVE CONTAINER	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the container was between the FULL and ADD marks at normal engine operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.

**ENGINE THERMOSTAT TESTING**

The thermostat is operated by a wax filled container (pellet) which is sealed. When heated coolant reaches a predetermined temperature the wax pellet expands enough to overcome the closing spring and water pump pressure, which forces the valve to open. Coolant leakage into the pellet will cause a thermostat to fail open. Do not attempt to free up a thermostat with a screwdriver.

The thermostat that opens too soon type failure mode is included in the on-board diagnosis. The check engine light will not be lit by an open too soon condition. If it has failed open, a diagnostic trouble code (DTC) will be set. Do not change a thermostat for lack of heater performance or temperature gauge position, unless a DTC is present. See Diagnosis for other probable causes. Thermostat failing shut is the normal long term mode of failure, and normally, only on high mileage vehicles. The temperature gauge will indicate this. Refer to Diagnosis in this section.

**WATER PUMP DIAGNOSIS**

A quick flow test to tell whether or not the pump is working is to see if the heater warms properly. A defective pump will not be able to circulate heated coolant through the long heater hose.

Another flow test to help determine pump operation, remove radiator cap.

**WARNING: DO NOT remove radiator cap if the cooling system is hot or under pressure.**

**COOLING SYSTEM FLOW CHECK**

To determine whether coolant is flowing through the cooling system, use the following procedures:

(1) If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If it is hot, coolant is circulating.

**WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.**

(2) Remove pressure cap when engine is cold, remove small amount of coolant. Idle engine until thermostat opens, you should observe coolant flow while looking down the filler neck. Once flow is detected install the pressure cap.

## DIAGNOSIS AND TESTING (Continued)

### RADIATOR FAN CONTROL

The radiator has a single cooling fan, with a two speed motor (Fig. 13). The fan is controlled by the Powertrain Control Module (PCM) which energizes the fan relay. Fan operation is accomplished three ways:

- When air conditioning system pressure reaches 210 psi, fan will operate.
- Coolant temperature reaches 215° F, fan will operate.
- Models equipped with automatic transmission, a fluid thermister may have some influences on fan operation.
- Refer to tables below for fan operation.

#### RADIATOR FAN OPERATION—2.5L ENGINE

Radiator Fan Control			A/C Pressure	
A/C Off	Low	High		
Fan On:	102°C (215°F)	107°C (224°F)		
Fan Off:	96°C (205°F)	103°C (217°F)		
A/C On	Low	High	Low	High
Fan On:	102°C (215°F)	107°C (224°F)	1,448 Kpa (210 psi)	1,718 Kpa (249 psi)
Fan Off:	96°C (205°F)	101°C (213°F)	1,207 Kpa (175 psi)	1,585 Kpa (229 psi)
EATX Fluid Temperature			Low Speed	High Speed
Fan On:			118°C (244°F)	122°C (252°F)
Fan Off:			116°C (240°F)	118°C (244°F)

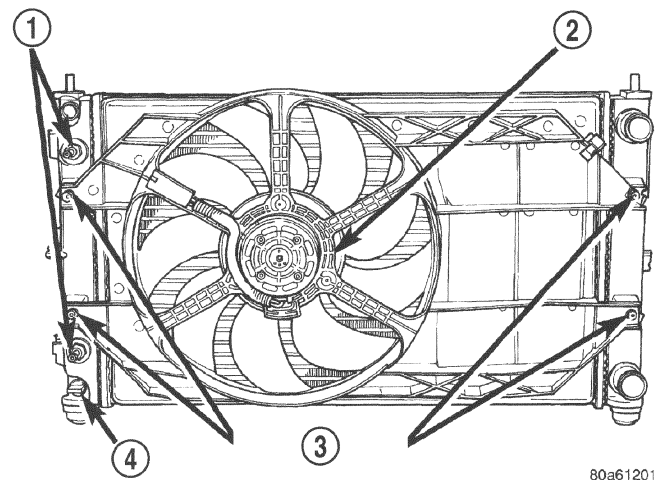
### ELECTRIC FAN MOTOR TEST

Refer to Powertrain Diagnostic Manual for procedure.

For wiring diagrams of the fan motor systems refer to Group, 8W Wiring Diagrams.

### COOLANT CONCENTRATION TESTING

Coolant concentration should be checked when any additional coolant was added to system or after a coolant drain, flush and refill. The coolant mixture



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**Fig. 13 Cooling Fan**

- 1 - TRANSMISSION OIL COOLER
- 2 - SINGLE FAN
- 3 - FAN MODULE FASTENERS
- 4 - DRAINCOCK

offers optimum engine cooling and protection against corrosion when mixed to a freeze point of -37°C (-34°F) to -59°C (-50°F). The use of a hydrometer or a refractometer can be used to test coolant concentration.

A hydrometer will test the amount of glycol in a mixture by measuring the specific gravity of the mixture. The higher the concentration of ethylene glycol, the larger the number of balls that will float, and higher the freeze protection (up to a maximum of 70% by volume glycol).

A refractometer will test the amount of glycol in a coolant mixture by measuring the amount a beam of light bends as it passes through the fluid.

Some coolant manufactures use other types of glycols into their coolant formulations. Propylene glycol is the most common new coolant. However, propylene glycol based coolants do not provide the same freezing protection and corrosion protection and is only recommended for limited usage. Refer to appropriate Technical Service Bulletin(s) regarding use of propylene glycol based coolants.

**CAUTION: Do not mix types of coolant—corrosion protection will be severely reduced.**

Because ethylene glycol and propylene glycol do not have the same specific gravities, the use of a hydrometer will be inaccurate. Therefore, Special Tool 8286 refractometer, is recommended when testing either ethylene or propylene glycol coolants.

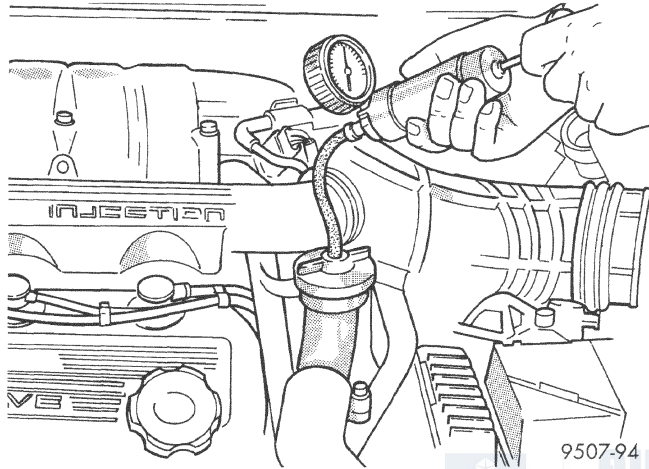


**DIAGNOSIS AND TESTING (Continued)****COOLING SYSTEM LEAK TESTING**

With engine not running, wipe the coolant filler neck sealing seat clean. The radiator should be full.

Attach a radiator pressure tester to the coolant filler neck, as shown in (Fig. 14) and apply 104 kPa (15 psi) pressure. If the pressure drops more than 2 psi in 2 minutes inspect all points for external leaks.

All hoses, radiator and heater, should be moved while at 104 kPa (15 psi) since some leaks occur while driving due to engine rock, etc.



**Fig. 14 Pressure Testing Cooling System—Typical**

If there are no external leaks after the gauge dial shows a drop in pressure, detach the tester. Start engine and run the engine to normal operating temperature in order to open the thermostat and allow the coolant to expand. Reattach the tester. If the needle on the dial fluctuates, it indicates a combustion leak and is usually a head gasket leak.

**WARNING: WITH TOOL IN PLACE PRESSURE BUILDS UP FAST. ANY EXCESSIVE AMOUNT OF PRESSURE BUILT UP BY CONTINUOUS ENGINE OPERATION MUST BE RELEASED TO A SAFE PRESSURE POINT. NEVER PERMIT PRESSURE TO EXCEED 138 kPa (20 psi).**

If the needle on the dial does not fluctuate, race the engine a few times. If an abnormal amount of coolant or steam is emitted from the tailpipe, it may indicate a faulty head gasket, cracked engine block or cylinder head.

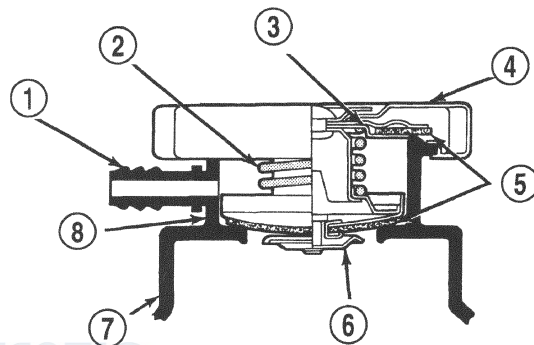
There may be internal leaks which can be determined by removing the oil dipstick. If water globules appear intermixed with the oil, it will indicate an internal leak in the engine. If there is an internal leak, the engine must be disassembled for repair.

**COOLING SYSTEM PRESSURE RELIEF CHECK**

The pressure cap upper gasket to filler neck seal can be checked by removing the overflow hose at the

radiator filler neck overflow nipple (Fig. 15). Attach the radiator pressure tester to the **filler neck overflow nipple**, and pump air into the system. The pressure cap upper gasket should relieve pressure at 69-124 kPa (10-18 psi), and hold pressure at 55 kPa (8 psi) minimum.

**WARNING: THE WARNING WORDS “DO NOT OPEN HOT” ON THE PRESSURE CAP IS A SAFETY PRECAUTION. WHEN HOT, THE COOLING SYSTEM BUILDS UP PRESSURE. TO PREVENT SCALDING OR OTHER INJURY, THE PRESSURE CAP SHOULD NOT BE REMOVED WHILE THE SYSTEM IS HOT AND/OR UNDER PRESSURE.**



**Fig. 15 Cooling System Pressure Cap to Filler Neck**

- 1 - OVERFLOW NIPPLE
- 2 - MAIN SPRING
- 3 - GASKET RETAINER
- 4 - STAINLESS-STEEL SWIVEL TOP
- 5 - RUBBER SEALS
- 6 - VENT VALVE
- 7 - THERMOSTAT HOUSING/ENGINE OUTLET CONNECTOR
- 8 - FILLER NECK

There is no need to remove the pressure cap at any time **except** for the following purposes:

- Check and adjust coolant freeze point
- Refill system with new coolant
- Conducting service procedures
- Checking for leaks

**WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT 15 MINUTES BEFORE REMOVING CAP. PLACE A SHOP TOWEL OVER THE CAP, AND WITHOUT PUSHING DOWN, ROTATE IT COUNTERCLOCKWISE TO THE FIRST STOP. ALLOW FLUIDS TO ESCAPE THROUGH THE OVERFLOW TUBE. WHEN THE SYSTEM STOPS PUSHING COOLANT AND STEAM INTO THE CRS TANK AND PRESSURE DROPS, PUSH DOWN ON THE CAP AND REMOVE IT COMPLETELY. SQUEEZING THE RADIATOR INLET HOSE WITH A SHOP TOWEL (TO CHECK PRESSURE) BEFORE AND AFTER TURNING TO THE FIRST STOP IS RECOMMENDED.**

**DIAGNOSIS AND TESTING (Continued)****COOLING SYSTEM PRESSURE CAP TESTING**

Dip the pressure cap in water; clean off any deposits on the vent valve or its seat, and apply the cap to end of radiator pressure tester (Fig. 16). Working the plunger, increase the pressure to 104 kPa (15 psi) on the gauge. If the pressure cap fails to hold pressure of at least 97 kPa (14 psi), replace the cap.

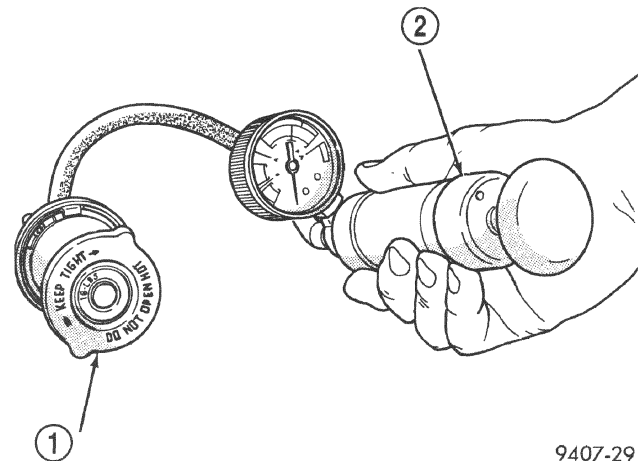
**CAUTION:** The radiator pressure tester is very sensitive to small air leaks that will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to the tool. Turn the tool upside down, and recheck the pressure cap to confirm that the cap is faulty.

If the pressure cap tests properly while positioned on the radiator pressure tester, but will not hold pressure or vacuum when positioned on the filler neck, inspect the filler neck and cap top gasket for irregularities that may prevent the cap from sealing properly.

**LOW COOLANT LEVEL AERATION**

Low coolant level in a cross flow radiator will equalize in both tanks with engine off. With engine at running operating temperature the high pressure inlet tank runs full and the low pressure outlet tank drops. If this level drops below the top of the transmission oil cooler, air will be sucked into the water pump:

- Transmission oil will become hotter.
- High reading shown on the temperature gauge.
- Air in the coolant will also cause loss of flow through the heater.
- Exhaust gas leaks into the coolant can also cause the same problems.



**Fig. 16 Pressure Testing Radiator Cap**

- 1 - PRESSURE CAP  
2 - PRESSURE TESTER

**COOLING SYSTEM DEAERATION**

Air can only be removed from the system by gathering under the pressure cap. On the next heat up it will be pushed past the pressure cap into the coolant recovery container by thermal expansion of the coolant. It then escapes to the atmosphere in the coolant recovery container and is replaced with coolant on cool down.

**ACCESSORY DRIVE BELT**

Satisfactory performance of the belt driven accessories depends on belt condition and proper belt tension.

**DIAGNOSIS AND TESTING (Continued)****ACCESSORY DRIVE BELT DIAGNOSIS**

CONDITION	POSSIBLE CAUSE	CORRECTION
INSUFFICIENT ACCESSORY OUTPUT DUE TO BELT SLIPPAGE	1. Belt too loose. 2. Belt excessively glazed or worn.	1. Adjust belt tension. 2. Replace and tighten as specified.
BELT SQUEAL WHEN ACCELERATING ENGINE	1. Belts too loose. 2. Belts glazed.	1. Adjust belt tension. 2. Replace belts.
BELT CHIRP AT IDLE	1. Belts too loose. 2. Foreign material imbedded in belt. 3. Non-uniform belt. 4. Misaligned pulley(s). 5. Non-uniform groove or eccentric pulley.	1. Adjust belt tension. 2. Replace belt. 3. Replace belt. 4. Align accessories. 5. Replace pulley(s).
BELT ROLLED OVER IN GROOVE OR BELT JUMPS OFF	1. Broken cord in belt. 2. Belt too loose, or too tight. 3. Misaligned pulleys. 4. Non-uniform grooves or eccentric pulley.	1. Replace belt. 2. Adjust belt tension. 3. Align accessories. 4. Replace pulley(s).

**ENGINE BLOCK HEATER**

If unit does not operate, trouble can be in either the power cord or the heater element. Test power cord for continuity with a 110-volt voltmeter or 110-volt test light; test heater element continuity with an ohmmeter or 12-volt test light.

**SERVICE PROCEDURES****COOLANT LEVEL CHECK—ROUTINE**

**Do not remove radiator cap for routine coolant level inspections.**

The coolant reserve system provides a quick visual method for determining the coolant level without removing the radiator cap. **With the engine cold and not running**, simply observe the level of the coolant in the reserve tank. The level should be between the minimum and maximum marks.

**COOLANT—ADDING ADDITIONAL**

**NOTE:** The radiator cap should not be removed.

When additional coolant is needed, it should be added to the coolant recovery/reserve container (Fig. 17). Use only 50/50 concentration of ethylene glycol type antifreeze and water.

**COOLANT LEVEL SERVICING—2.5L ENGINE**

**NOTE:** The cooling system is closed and designed to maintain coolant level to the top of the radiator.

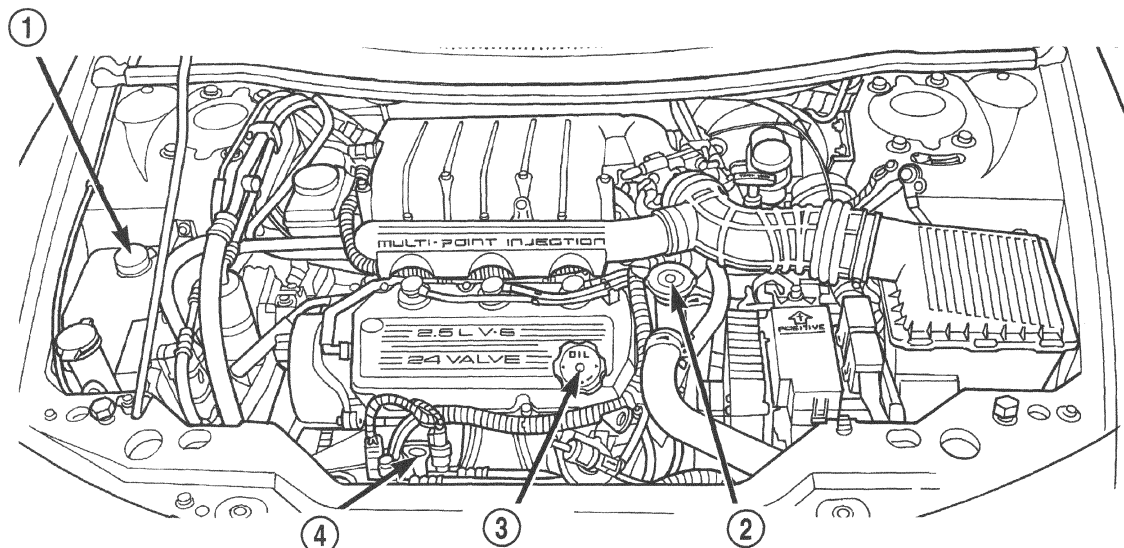
When servicing requires a coolant level check in the radiator, the engine must be **off** and **not** under pressure. Drain several ounces of coolant from the radiator drain cock while observing the Coolant Recovery Container. Coolant level in the container should drop slightly. Then remove the radiator cap (Fig. 17). The radiator should be full to the top. If not, and the coolant level in the recovery container is at the ADD mark there is a air leak in the recovery system. Check hose or hose connections to the recovery container, radiator filler neck or the pressure cap seal to the radiator filler neck for leaks.

**COOLING SYSTEM—DRAINING**

**NOTE:** Drain, flush, and fill the cooling system at the mileage or time intervals specified in the Group 0, Lubrication and Maintenance. If the solution is dirty, rusty or contains a considerable amount of sediment, clean and flush with a reliable cooling system cleaner. Care should be taken in disposing of the used engine coolant. Check governmental regulations for disposal of used engine coolant.



## SERVICE PROCEDURES (Continued)



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Fig. 17 Coolant Recovery Container and Pressure Cap Locations—2.5L Engine

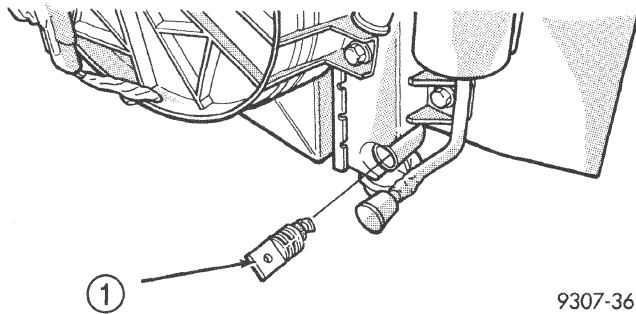
- 1 - COOLANT RECOVERY CONTAINER  
2 - COOLANT PRESSURE CAP

- 3 - ENGINE OIL FILL  
4 - ENGINE OIL DIPSTICK

**WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP OR OPEN THE RADIATOR DRAINCOCK, WHEN SYSTEM IS HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.**

To drain cooling system move temperature selector for heater to full heat with engine running (to provide vacuum for actuation). **Without removing radiator pressure cap and with system not under pressure**, Shut engine off and open draincock (Fig. 18). The coolant reserve tank should empty first, then remove radiator pressure cap. (if not, see Testing Cooling System for leaks).

**NOTE: To open draincock on vehicle equipped with 2.5L engine, use a 3/8 inch drive extension 3" long, a 19mm socket with universal.**



9307-36

Fig. 18 Draincock—Typical

- 1 - DRAIN COCK BODY

## COOLING SYSTEM—REFILLING

First clean system to remove old glycol, see Cooling System Cleaning.

Fill system with 50/50 glycol/water mix. Use anti-freeze described in Coolant section. The thermostat in the these engines allow air to flow through them.

Continue filling system until full, this provides better heater performance. **Be careful not to spill coolant on drive belts or the generator.**

Fill coolant recovery/reserve container (Fig. 17) to at least the FULL HOT mark with 50/50 glycol/water mix. It may be necessary to add coolant to the recovery/reserve container to maintain coolant level between the FULL HOT and ADD mark after three or four warm-up/cool down cycles and also, if any trapped air that has been removed from cooling system.

## REMOVAL AND INSTALLATION

## WATER PUMP—2.5L ENGINE

## REMOVAL

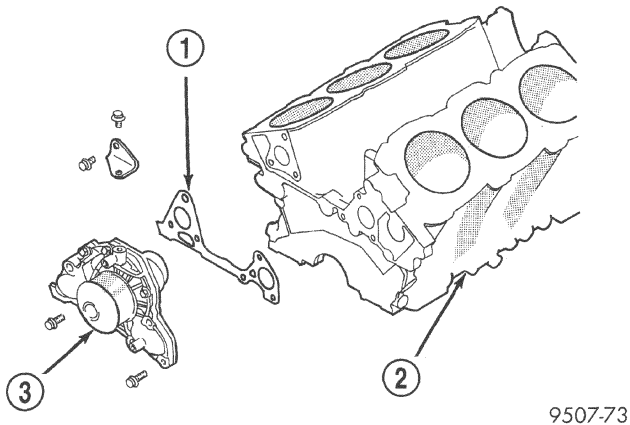
(1) Drain cooling system. Refer to Cooling System Draining in this section.

(2) Remove right engine mount and bracket. Refer to Group 9, Engine for procedure.

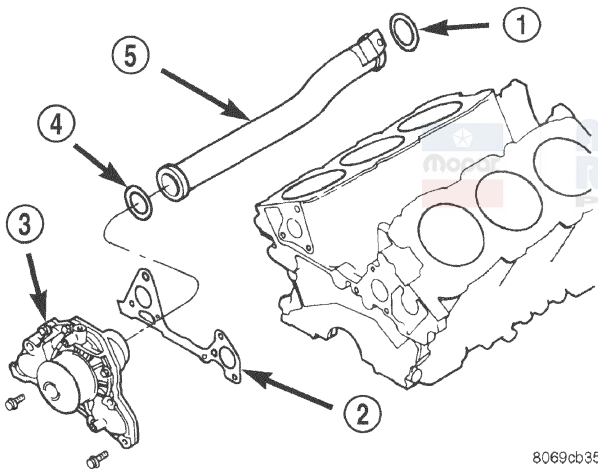
(3) Remove timing belt. Refer to Group 9, Engine for procedure.

(4) Remove water pump mounting bolts.

(5) Separate pump from water inlet pipe (Fig. 20) and remove pump (Fig. 19).

**REMOVAL AND INSTALLATION (Continued)****Fig. 19 Water Pump—2.5L Engine**

- 1 - GASKET
- 2 - ENGINE BLOCK
- 3 - WATER PUMP

**Fig. 20 Water Pump Inlet Tube**

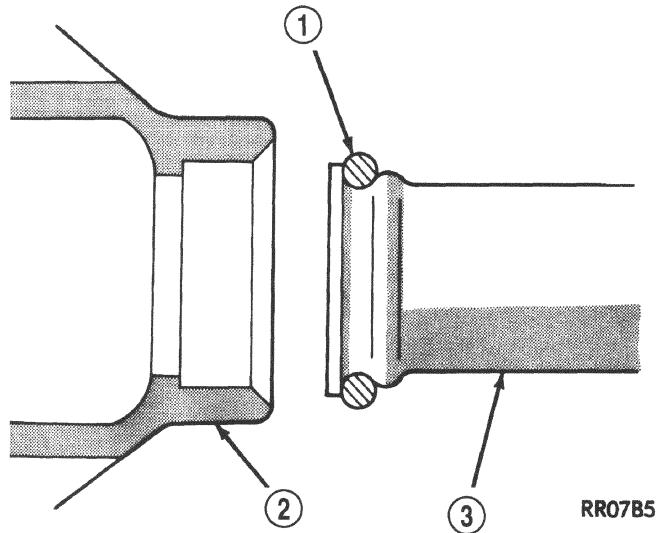
- 1 - O-RING
- 2 - GASKET
- 3 - WATER PUMP
- 4 - O-RING
- 5 - INLET PIPE

**INSTALLATION**

- (1) Clean all gasket and O-ring surfaces on pump and water pipe inlet tube.
- (2) Install new O-ring on water inlet pipe (Fig. 21). Wet the O-ring with water to facilitate assembly.

**CAUTION:** Keep the O-ring free of oil or grease.

- (3) Install new gasket on water pump and install pump inlet opening over water pipe, press assembly to cause water pipe insertion into pump housing.

**Fig. 21 Water Pipe O-Ring**

- 1 - O-RING
- 2 - PUMP HOUSING
- 3 - WATER PIPE

- (4) Install pump to block mounting bolts and tighten to 27 N·m (20 ft. lbs.).

- (5) Install timing belt and right engine mount bracket and mount. Refer to Group 9, Engine for procedure.

- (6) Fill cooling system. See Cooling System Refilling.

- (7) Install accessory drive belts. Refer to Accessory Drive Belts, in this section for procedure.

**THERMOSTAT—2.5L ENGINE****REMOVAL**

- (1) Drain cooling system to the thermostat level or below.

- (2) Remove inlet hose and coolant inlet elbow from thermostat housing (Fig. 22).

- (3) Remove thermostat assembly, and clean sealing surfaces.

**INSTALLATION**

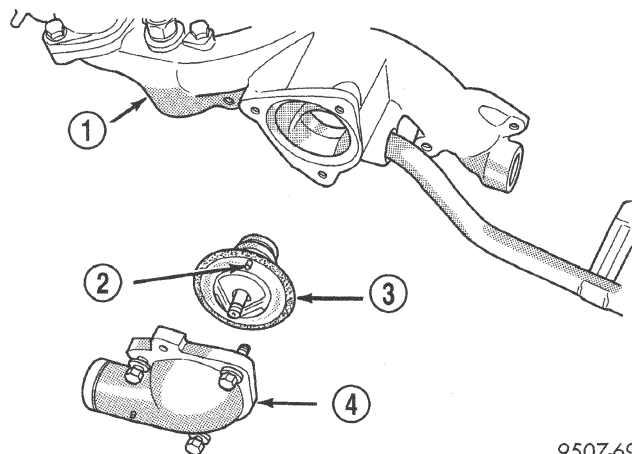
- (1) Install thermostat into the recess in the thermostat housing.

- (2) Install inlet elbow and tighten the bolts to 19 N·m (168 in. lbs.) (Fig. 22).

- (3) Fill cooling system. Refer to Cooling System Refilling in this section.

**RADIATOR****REMOVAL**

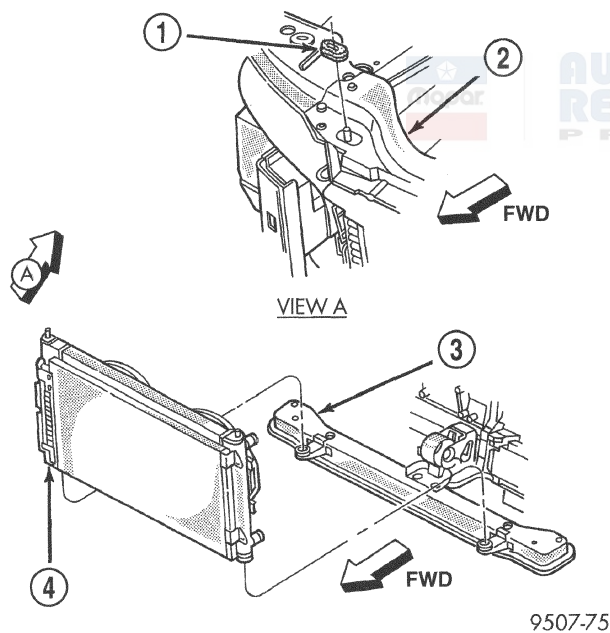
- (1) Disconnect negative cable from auxiliary jumper terminal.

**REMOVAL AND INSTALLATION (Continued)**

9507-69

**Fig. 22 Thermostat, Housing and Inlet Elbow—2.5L Engine**

- 1 - THERMOSTAT HOUSING
- 2 - VENT INSTALLED UPWARD
- 3 - THERMOSTAT
- 4 - COOLANT INLET ELBOW



9507-75

**Fig. 23 Cooling Module Mounting**

- 1 - ISOLATOR
- 2 - UPPER RADIATOR CROSSMEMBER
- 3 - VIEW A
- 4 - LOWER RADIATOR CROSSMEMBER
- 5 - COOLING MODULE
- 6 - FWD
- 7 - FWD

(2) Remove air inlet resonator. Refer to Group 14, Fuel System for procedure.

**WARNING: DO NOT REMOVE THE CYLINDER BLOCK PLUG OR THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.**

(3) Drain cooling system. Refer to Cooling System Draining in this section.

(4) Remove upper radiator crossmember (Fig. 23). Refer to Group 23, Body for procedure.

**CAUTION: Plastic tanks, while stronger than brass are subject to damage by impact, such as wrenches.**

(5) Remove hose clamps and hoses from the radiator.

(6) Disconnect the fan wiring connector.

(7) Remove fan module.

(8) Disconnect automatic transmission hoses from cooler and plug off.

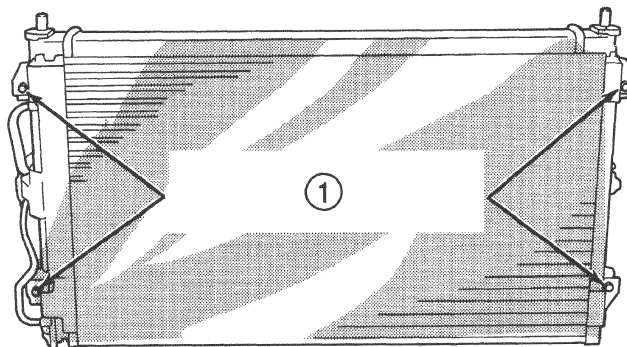
(9) Remove screw attaching support bracket for external transmission oil cooler lines to left side of radiator (if equipped).

(10) Disconnect the engine block heater wire, if equipped.

**CAUTION: Avoid bending the condenser inlet tube. Care should be taken not to damage radiator or condenser cooling fins or water tubes during removal.**

(11) Remove screw attaching support bracket for air conditioning lines from right side of radiator. Remove support bracket.

(12) Remove the air conditioning condenser attaching screws located at the front of the radiator (Fig. 24), if equipped. It is not necessary to discharge the air conditioning system to remove radiator.



9507-82

**Fig. 24 A/C Condenser to Radiator Mounting Screws**

- 1 - AIR CONDITIONING CONDENSER TO RADIATOR MOUNTING SCREWS



**REMOVAL AND INSTALLATION (Continued)**

(13) Radiator can now be lifted free from engine compartment. **Care should be taken not to damage radiator cooling fins or water tubes during removal.**

**INSTALLATION**

(1) Slide radiator and fan module down into position, seat the radiator assembly lower rubber isolators in the mount holes provided.

(2) Attach air conditioning condenser to radiator, if equipped. Tighten mounting screws to 5 N·m (45 in. lbs.).

(3) Install air conditioning line support bracket and attaching screw to right side of radiator.

(4) Connect engine block heater wire, if equipped.

(5) Connect lower radiator hose and clamp.

(6) Install external transmission oil cooler line support bracket and attaching screw to left side of radiator (if equipped).

(7) Connect automatic transmission hoses; tighten hose clamps to 2.5 N·m (22 in. lbs.).

(8) Install fan module.

(9) Connect fan motor electrical connection.

(10) Install upper radiator hose. Align hose so it does not interfere with the accessory drive belt or engine. Position hose clamp so it will not interfere with the hood liner.

(11) Install upper radiator crossmember. Refer to Group 23, Body for procedure.

(12) Connect negative cable to auxiliary jumper terminal.

(13) Fill cooling system with coolant. Refer to Cooling System Refilling in this section.

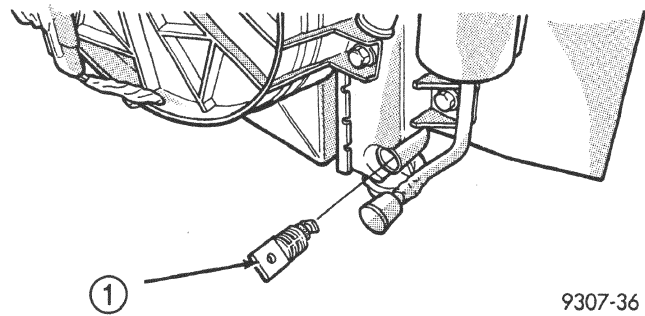
(14) Operate engine until it reaches normal operating temperature. Check cooling system and automatic transmission for correct fluid levels.

**RADIATOR DRAINCOCK****REMOVAL**

**CAUTION:** Plastic tanks, while stronger than brass are subject to damage by impact, such as wrenches.

(1) Turn the draincock stem counterclockwise to unscrew the stem. When the stem is unscrewed to the end of the threads, pull the stem (Fig. 25) from the radiator tank.

**NOTE:** To open draincock on vehicle equipped with 2.5L engine, use a 3/8 inch drive extension 3" long, a 19mm socket with universal.



9307-36

**Fig. 25 Draincock—Typical**

1 - DRAIN COCK BODY

**INSTALLATION**

(1) Push the draincock assembly body into the tank opening until it snaps into place.

(2) Tighten the draincock stem by turning clockwise to 2.0-2.7 N·m (18-25 in. lbs.) torque.

**RADIATOR FAN, MOTOR AND SHROUD****REMOVAL**

(1) Remove upper radiator crossmember. Refer to Group 23, Body for procedure.

(2) Disconnect fan motor electrical connector.

(3) Remove fasteners attaching fan module to radiator (Fig. 27).

(4) Remove fan module.

**FAN SERVICE**

There are no repairs to be made to the fan. If the fan is warped, cracked, or otherwise damaged, it must be replaced with **only** the recommended part for adequate strength, performance and safety.

(1) To remove fan from motor shaft, bench support the motor and motor shaft, while removing the fan retaining clip, so that the shaft and motor will not be damaged by excessive force. **Surface burr removal may be required to remove fan from motor shaft (Fig. 26).** Do not permit the fan blades to touch the bench.

(2) To install fan on motor shaft, slide the fan over shaft. Support motor and shaft as above while installing fan retaining clip.

**FAN SHROUD**

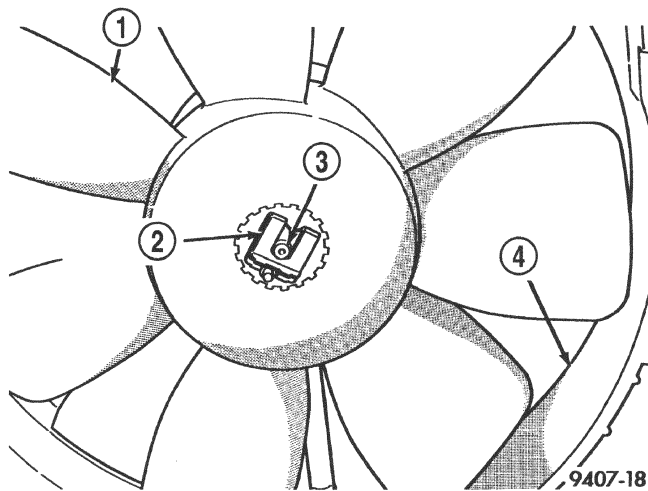
All vehicles have fan shrouds to improve fan air flow efficiency.

The shroud supports the electric fan motor and fan (Fig. 27). For removal and installation procedures, refer to Radiator Section.

**FAN MOTOR SERVICE**

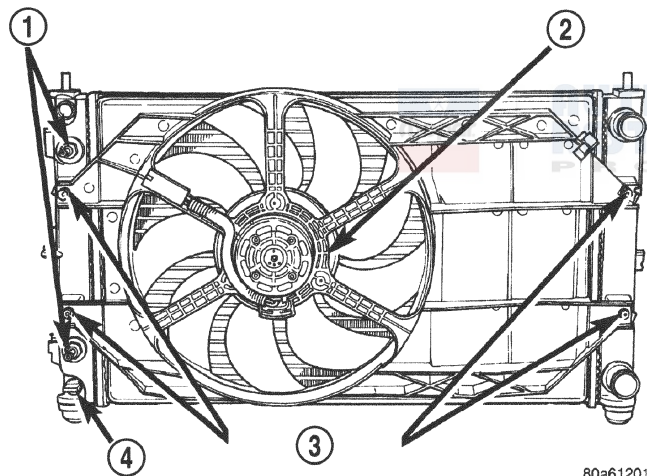
(1) Remove the motor fasteners from support. Remove motor from support.

## REMOVAL AND INSTALLATION (Continued)



**Fig. 26 Radiator Fan—Removal**

- 1 - FAN
- 2 - RETAINING CLIP
- 3 - MOTOR SHAFT
- 4 - SHROUD ASSEMBLY



**Fig. 27 Fan Module**

- 1 - TRANSMISSION OIL COOLER
- 2 - SINGLE FAN
- 3 - FAN MODULE FASTENERS
- 4 - DRAINCOCK

(2) Reverse the above procedure for Installation. Tighten fan motor fasteners to 5 N·m (45 in. lbs.).

### INSTALLATION

(1) Install fan module to radiator. Tighten shroud to radiator fasteners to 7.5 N·m (65 in. lbs.).

(2) Connect fan motor lead. **For wiring diagrams of fan motor systems refer to Group, 8W Wiring Diagrams.**

(3) Install upper radiator crossmember. Refer to Group 23, Body for procedure.

## COOLANT RECOVERY BOTTLE

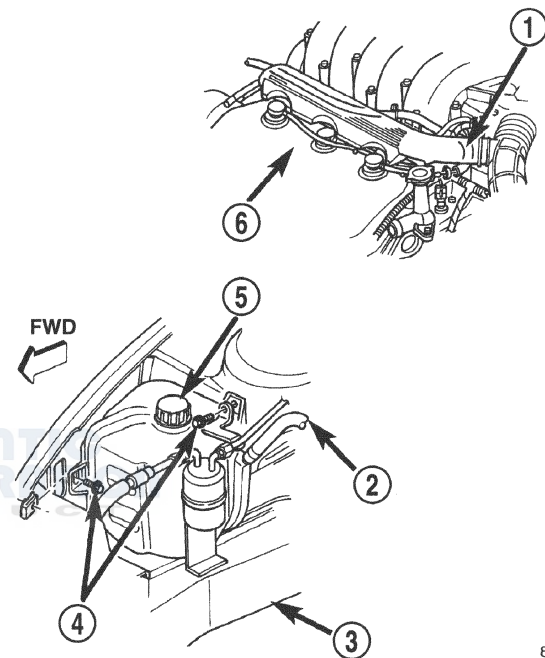
### REMOVAL

- (1) Disconnect coolant hose from bottle.
- (2) Remove bottle attaching screws (Fig. 28).
- (3) Remove bottle (Fig. 28).

### INSTALLATION

(1) Position bottle and install attaching screws (Fig. 28). Tighten screws to 4.6 N·m (40 in. lbs.).

(2) Connect coolant hose to bottle.



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**Fig. 28 Coolant Recovery Bottle**

- 1 - TO CRS BOTTLE
- 2 - TO ENGINE
- 3 - RIGHT FRAME RAIL
- 4 - SCREWS (2) 4.6 N·m (40 in. lbs.)
- 5 - COOLANT RECOVERY SYSTEM (CRS) BOTTLE
- 6 - 2.5L ENGINE
- 7 - FWD

## ENGINE BLOCK HEATER

### REMOVAL

(1) Drain coolant from radiator and cylinder block. Refer to Cooling System Drain, Clean, Flush and Refill of this section for procedure.

(2) Detach power cord plug from heater.

(3) Loosen screw in center of heater. Remove heater assembly.

### INSTALLATION

(1) Thoroughly clean core hole and heater seat (Fig. 29).

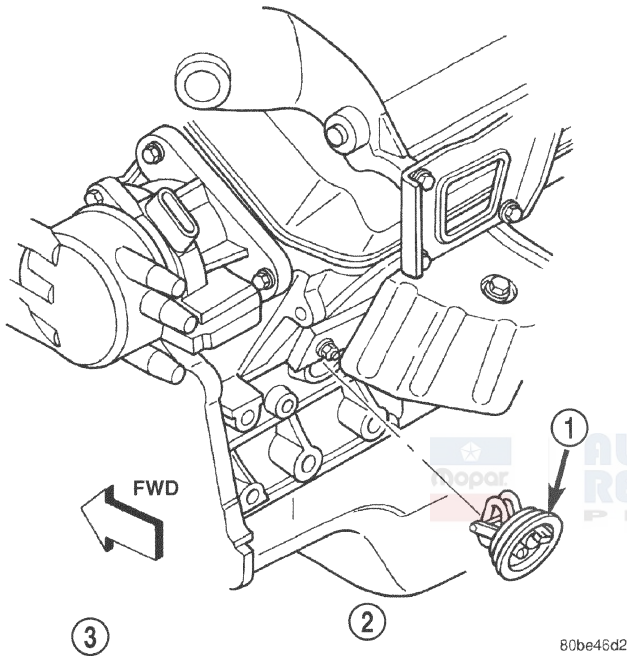
**REMOVAL AND INSTALLATION (Continued)**

(2) Insert heater assembly with electrical connector position at the top of the core hole.

(3) With heater seated, tighten center screw securely to assure a positive seal.

(4) Fill cooling system with coolant to the proper level, vent air, and inspect for leaks. Pressurize system with Radiator Pressure Tool before looking for leaks.

The power cord must be secured in its retainer clips, and not positioned so it could contact linkages or exhaust manifolds and become damaged.



**Fig. 29 Engine Block Heater**

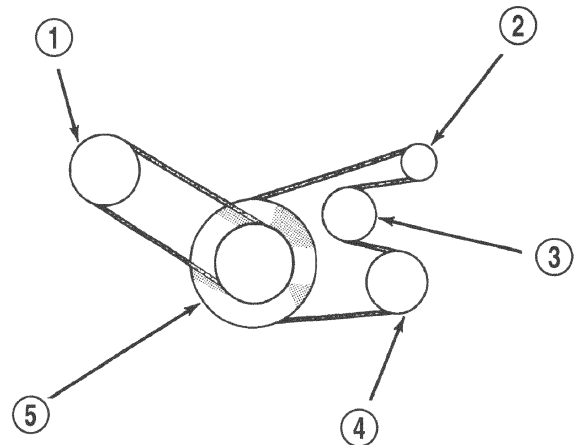
- 1 - BLOCK HEATER
- 2 - 2.5L ENGINE
- 3 - LEFT REAR SIDE VIEW
- 4 - FWD

**ACCESSORY DRIVE BELTS****AIR CONDITIONING AND GENERATOR BELT****REMOVAL**

- (1) Remove power steering pump drive belt. Refer to procedure in this section.
- (2) Loosen idler pulley locking bolt (Fig. 31).
- (3) Loosen the adjusting screw to decrease the idler pulley tension (Fig. 31).
- (4) Remove belt.

**INSTALLATION**

- (1) Refer to (Fig. 30) for belt routing.
- (2) Install drive belt on pulleys.



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**Fig. 30 Accessory Drive Belt Routing—2.5L Engine**

- 1 - POWER STEERING PUMP
- 2 - GENERATOR
- 3 - IDLER
- 4 - AIR CONDITIONING COMPRESSOR
- 5 - CRANKSHAFT DAMPER

**NOTE: Use Special Tool 7198, Belt Tension Gauge to check belt for proper tension.**

(3) Tighten the adjusting screw until belt is tensioned to specifications. Refer to Belt Tension Chart for specifications.

(4) Tighten idler pulley locking bolt to 54 N·m (40 ft. lbs.). Recheck belt for proper tension and adjust as necessary.

(5) Install power steering pump drive belt.

**Air Conditioning and Generator Belt Tension Adjustment**

To adjust the air conditioning and generator drive belt, loosen the idler pulley locking bolt and adjust belt tension by turning adjusting screw (Fig. 31). Use Belt Tension Gauge and refer to Belt Tension Chart for specification. Tighten pulley bolt to 54 N·m (40 ft. lbs.) after adjustment.

**POWER STEERING PUMP BELT****REMOVAL**

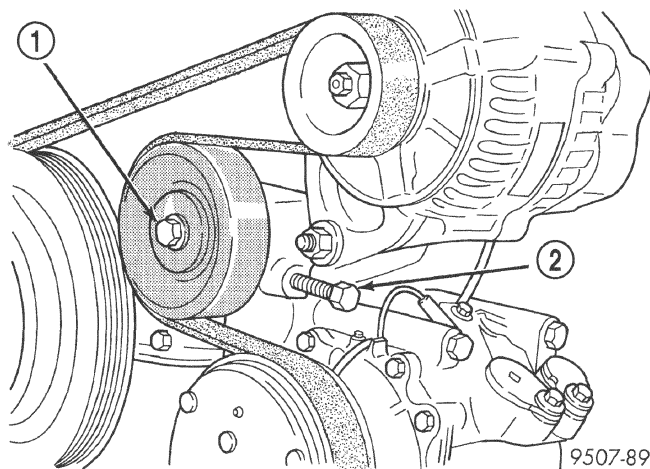
- (1) From the top of the vehicle loosen pivot bolt (Fig. 33).
- (2) Hoist vehicle and remove splash shield (Fig. 32).
- (3) From under the vehicle loosen the locking bolts F and G (Fig. 33).

**INSTALLATION**

- (1) Install belt. Refer to (Fig. 30) for belt routing.

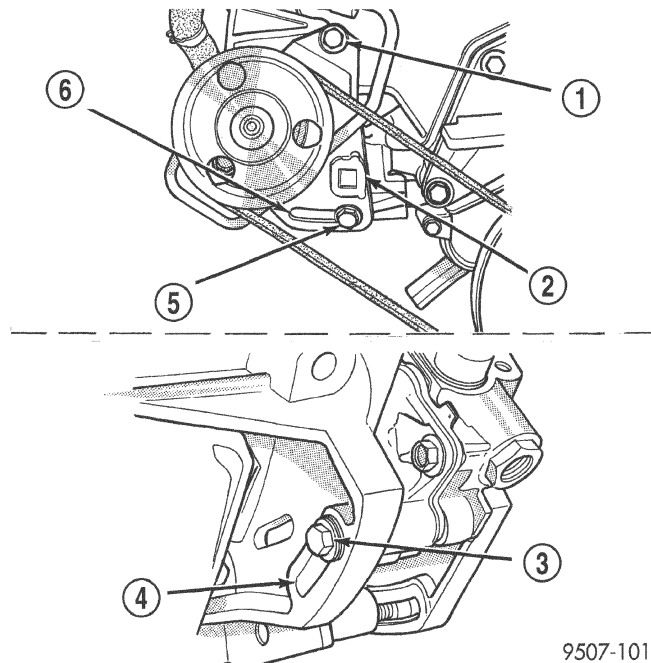
**NOTE: Use Special Tool 7198, Belt Tension Gauge to check belt for proper tension.**



**REMOVAL AND INSTALLATION (Continued)**

**Fig. 31 Air Conditioning Compressor and Generator Belt Idler**

- 1 - LOCKING BOLT  
2 - ADJUSTING BOLT



**Fig. 33 Power Steering Belt Adjustment**

- 1 - PIVOT BOLT  
2 - 1/2 INCH SQUARE OPENING  
3 - LOCKING BOLT (G)  
4 - ADJUSTMENT SLOT  
5 - LOCKING BOLT (F)  
6 - ADJUSTMENT SLOT

(3) Tighten locking bolt G to 28 N·m (250 in. lbs.) (Fig. 33).

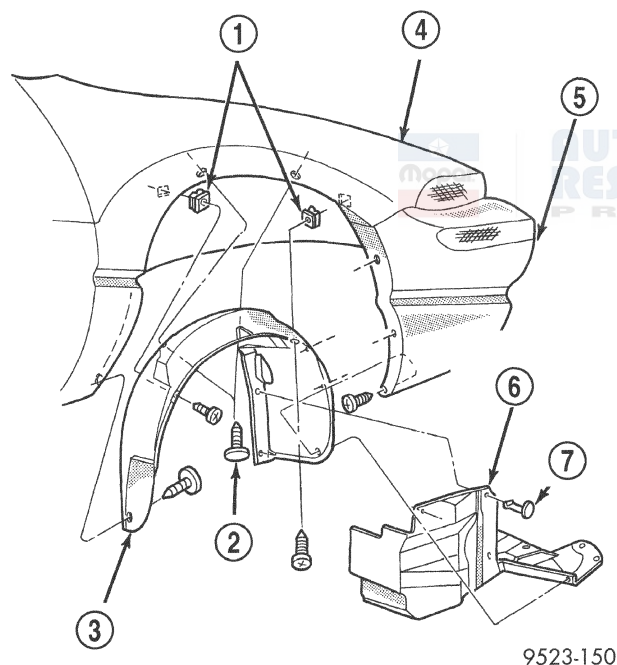
(4) Tighten locking bolt F and the pivot bolt to 54 N·m (40 ft. lbs.).

**Power Steering Pump Belt Tension Adjustment**

Refer to Power Steering Pump Belt installation procedures for belt tensioning procedures.

**BELT TENSION CHART**

ACCESSORY DRIVE BELTS	GAUGE	
2.5L ENGINE		
Air Conditioning Compressor & Generator Belt	New Belt:	667 N (150 lbs.)
Power Steering Pump Belt	Used Belt:	356 N (80 lbs.)



**Fig. 32 Accessory Drive Belt Splash Shield**

- 1 - NUT-SNAP  
2 - PUSH-IN FASTENER  
3 - WHEELHOUSE SPLASH SHIELD  
4 - FENDER  
5 - FASCIA  
6 - ACCESSORY DRIVE BELT SPLASH SHIELD  
7 - PUSH-IN FASTENER

(2) Adjust belt tension with 1/2 in. drive breaker bar installed in adjusting bracket (Fig. 33). Use belt tension gauge and refer to Belt Tension Chart for tension specification.

## CLEANING AND INSPECTION

### WATER PUMP—2.5L ENGINE

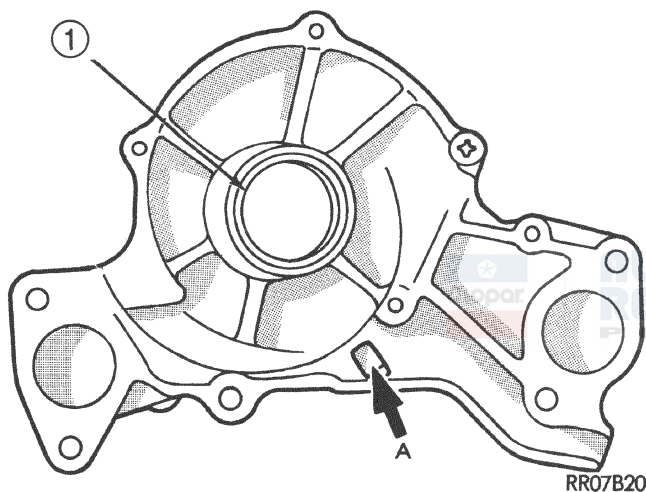
#### CLEANING

Clean all gasket mating surfaces as necessary.

#### INSPECTION

Replace the water pump if it has any of the following defects:

- Damage or cracks on the pump body.
- Coolant leaks, if the shaft seal is leaking, evident by traces of coolant leaks from vent hole "A" in (Fig. 34).
- Impeller rubs inside of pump.
- Excessively loose or rough turning bearing.



**Fig. 34 Water Pump Inspection**

1 - PUMP HOUSING INLET

### ACCESSORY DRIVE BELT

#### CLEANING

Clean all foreign debris from belt pulley grooves. The belt pulleys must be free of oil, grease, and coolants before installing the drive belt.

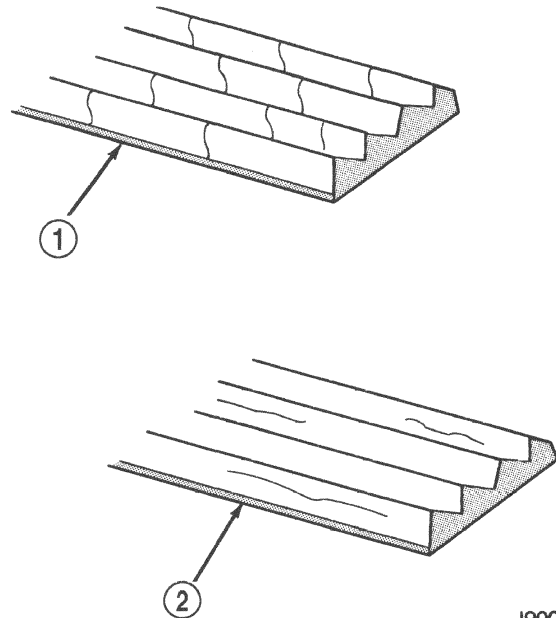
#### INSPECTION

Belt replacement under any or all of the following conditions is required:

- Excessive wear
- Frayed cords
- Severe glazing

Poly-V Belt system may develop minor cracks across the ribbed side. These minor cracks are considered normal and acceptable. Cracks parallel are not (Fig. 35).

**NOTE:** Do not use any type of belt dressing or restorer on Poly-V Belts.



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**Fig. 35 Drive Belt Wear Pattern**

- 1 - NORMAL CRACKS BELT OK
- 2 - NOT NORMAL CRACKS REPLACE BELT

### COOLING SYSTEM PRESSURE CAP

#### CLEANING

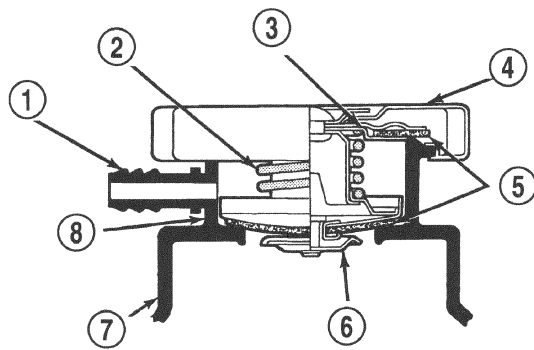
Use only a mild soap to clean the pressure cap.

#### INSPECTION

Hold the cap in your hand, **right side up** (Fig. 36). The vent valve at the bottom of the cap should open. If the rubber gasket has swollen, preventing the valve from opening, replace the cap.

Hold the cleaned cap in your hand, **upside down**. If any light can be seen between vent valve and the rubber gasket, replace the cap. **Do not use a replacement cap that has a spring to hold the vent shut.**

A replacement cap must be of the type designed for coolant reserve systems. This design ensures coolant return to the radiator.

**CLEANING AND INSPECTION (Continued)**

9407-12

**Fig. 36 Cooling System Pressure Cap**

- 1 - OVERFLOW NIPPLE
- 2 - MAIN SPRING
- 3 - GASKET RETAINER
- 4 - STAINLESS-STEEL SWIVEL TOP
- 5 - RUBBER SEALS
- 6 - VENT VALVE
- 7 - THERMOSTAT HOUSING/ENGINE OUTLET CONNECTOR
- 8 - FILLER NECK

**RADIATOR****CLEANING**

Clean radiator fins are necessary for good heat transfer. The radiator and air conditioning fins should be cleaned when an accumulation of debris has occurred. With the engine cold, apply cold water and compressed air to the back (engine side) of the radiator to flush the radiator and/or A/C condenser of debris.

**INSPECTION**

Inspect the radiator side tanks for cracks, broken or missing fittings also inspect the joint where the tanks seam up to the radiator core for signs of leakage and/or deteriorating seals.

Inspect radiator core for corroded, bent or missing cooling fins. Inspect the core for bent or damaged cooling tubes.

**COOLING SYSTEM CLEANING/FLUSHING****CLEANING**

**CAUTION:** Internal radiator pressure must not exceed 138 kPa (20 psi) as damage to radiator may result.

Reverse flushing of cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

(1) Drain cooling system. Remove thermostat housing and thermostat. Install thermostat housing.

(2) Connect a suitable cooling system flusher and follow instructions supplied with flusher.

**INSPECTION**

After performing a flush procedure, inspect all hoses, clamps and connections for deterioration and leaks. Inspect radiator and heater core for leaks.

**TRANSMISSION OIL COOLER****CLEANING**

For cooler flushing procedure, refer to Group 21, Transaxle.

Clean debris from cooling fins on external (air-to-oil) cooler as necessary.

**INSPECTION**

Inspect all hoses, tubes, clamps and connections for leaks, cracks, or damage. Replace as necessary. Use only approved transmission oil cooler hoses that are molded to fit the space available.

Inspect external coolers for leaks, loose mounts, or damage. Replace as necessary.

**ADJUSTMENTS****BELT TENSION GAUGE METHOD**

For conventional belts and Poly-V belts, use belt tensioning gauge Special Tool 7198 to obtain proper belt tension.

Adjust the belt tension for a **New** or **Used** belt as prescribed in the Belt Tension Chart.

**BELT TENSION CHART**

ACCESSORY DRIVE BELTS	GAUGE
2.5L ENGINE	
Air Conditioning Compressor & Generator Belt	New Belt: 667 N (150 lbs.)
Power Steering Pump Belt	Used Belt: 356 N (80 lbs.)

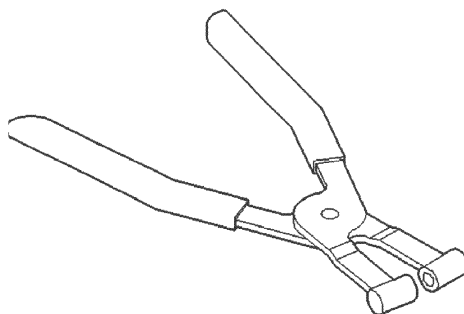
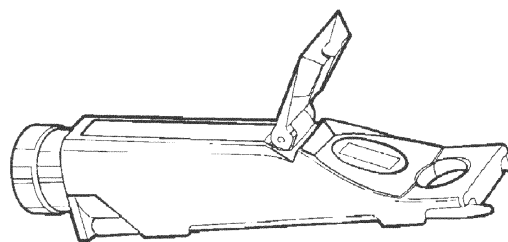


**SPECIFICATIONS****COOLING SYSTEM CAPACITY**

ENGINE	CAPACITY
2.5L	10.0* Liters (10.5* Quarts)
* CAPACITY, Includes Heater and Coolant Recovery System	

**TORQUE**

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
A/C Condenser to Radiator—Fasteners	5	—	45
Thermostat Housing 2.5L—Bolts	19	—	168
Water Pump Mounting 2.5L—Bolts	24	—	205
Water Pump Inlet Tube to Block—Bolts	12	—	105
Water Pump Inlet Pipe to Cylinder Head 2.5L—Fasteners	14	—	123
Fan Module to Radiator—Fasteners	7	—	65
Fan Motor to Shroud—Fasteners	5	—	45
Transmission Oil Cooler Hose—Clamps	2	—	18

**SPECIAL TOOLS****COOLING SYSTEM****Hose Clamp Pliers 6094****Coolant Refractometer 8286**

# BATTERY

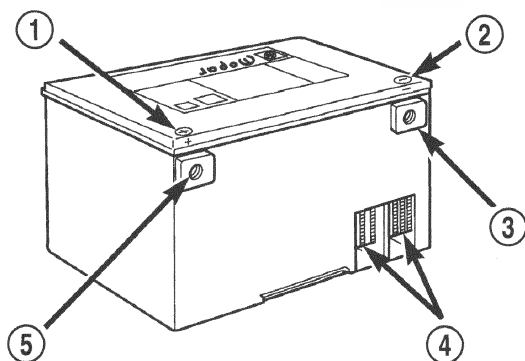
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## DESCRIPTION AND OPERATION

### BATTERY

#### DESCRIPTION



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**Fig. 1 Battery**

- 1 - (+) POLARITY SYMBOL
- 2 - (-) POLARITY SYMBOL
- 3 - NEGATIVE TERMINAL
- 4 - GROUP PLATES
- 5 - POSITIVE TERMINAL

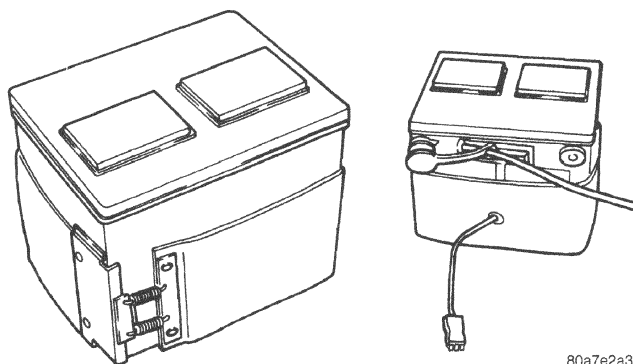
The battery is sealed and water cannot be added. A side post battery is used in this vehicle. It is located inside the left wheelwell behind a protective shield.

### OPERATION

The battery stores, stabilizes, and delivers electrical current to operate various electrical systems in the vehicle. The determination of whether a battery is good or bad is made by its ability to accept a charge. It also must supply high-amperage current for a long enough period to be able to start the vehicle. The capability of the battery to store electrical current comes from a chemical reaction. This reaction takes place between the sulfuric acid solution (electrolyte) and the lead +/- plates in each cell of the battery. As the battery discharges, the plates react with the acid from the electrolyte. When the charging system charges the battery, the water is converted to sulfuric acid in the battery. The concentration of acid in the electrolyte is measured as specific gravity using a hydrometer. The specific gravity indicates the battery's state-of-charge.

The battery is vented to release gases that are created when the battery is being charged and discharged.

The battery must be completely charged, and the battery side, posts, and cable terminals must be cleaned before diagnostic procedures are performed.

**DESCRIPTION AND OPERATION (Continued)****BATTERY BLANKET HEATER****DESCRIPTION**

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**Fig. 2 Battery Blanket Heater**

The 110 volt A. C. blanket heater is used to improve the battery cold start ability. The blanket heater is used with Alaska and Canada cold weather packages. It is wrapped around the battery and permanently left installed.

**OPERATION**

This vehicle has an electronic voltage regulator which controls battery charging. **ONLY CHRYSLER** approved battery blanket/block heater combination should be used. It is designed to provide optimum charging system performance in very cold ambient temperatures below -17.8°C (0°F). The addition of an aftermarket battery heater or engine block heater will adversely affect battery charging and will result in battery discharge or damage.

**IGNITION OFF DRAW (IOD) FUSE****DESCRIPTION**

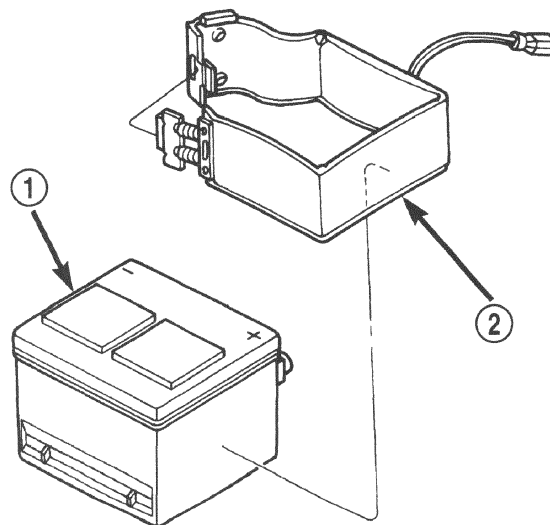
The Ignition Off Draw (IOD) fuse is located in the Junction Block cavity number 5. Removing this fuse will help prevent the battery from discharging during storage.

**OPERATION**

A completely normal vehicle will have a small amount of current drain on the battery with the key out of the ignition. It can range from 15 to 30 milliamperes after all the modules time out. If a vehicle will not be operated for approximately a 20 days, the IOD fuse should be disconnected to eliminate the vehicle electrical drain on the battery.

**DIAGNOSIS AND TESTING****BATTERY BLANKET HEATER INSPECTION**

- (1) Remove battery. Refer to battery removal.
- (2) Remove blanket heater from battery (Fig. 3).



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**Fig. 3 Battery Blanket Heater**

- 1 - BATTERY
- 2 - BATTERY BLANKET HEATER

**WARNING: SERIOUS PERSONAL INJURY AND/OR ELECTRICAL BURNS COULD RESULT IF THESE PROCEDURES ARE NOT FOLLOWED.**

(3) Clean battery blanket heater vinyl cover with a baking soda solution and wipe dry.

(4) Inspect blanket heater for cuts, abrasion or other damage. If heater is damaged replace. If OK, go to Step 5.

(5) Lay heater flat and connect heater to vehicle's connector.

(6) Connect the power cord to a 110 volt AC source for 3 minutes **MAXIMUM**.

(7) Disconnect voltage source from the power cord.

(8) Immediately feel the heater cover on the inside it should be warm to the touch. If warm, heater is OK. If not OK, go to Step 9.

(9) Using an Ohmmeter, connect a lead across the two terminals.

(10) Check for a resistance value of 220 to 280 Ohms. If within the resistance value range the blanket is OK. If not OK, replace blanket.

(11) Check extension cord to vehicle for voltage. If extension cord is OK, go to Step 12. If not OK, repair as necessary.

(12) Ensure heater receives voltage from extension cord and power cord. If OK, replace heater. If not OK, repair as necessary.



## DIAGNOSIS AND TESTING (Continued)

### BATTERY DISCHARGING

#### CAUSES OF BATTERY DISCHARGING

It is normal to have up to a 30 milliamperes continuous electrical draw ON the battery. This draw will take place with the ignition in the OFF position, and the courtesy, dome, storage compartments, and engine compartment lights OFF. The continuous draw is due to various electronic features or accesso-

ries that require electrical current with the ignition OFF to function properly. When a vehicle is not used over an extended period of approximately 20 days the IOD fuse should be disconnected. The IOD fuse is located in the Power Distribution Center and disconnection of this fuse will help prevent the battery from discharge during storage. Refer to Battery Diagnosis and Testing Table and to the proper procedures.

### BATTERY DIAGNOSIS AND TESTING

STEPS	POSSIBLE CAUSE	CORRECTION
VISUAL INSPECTION CHECK FOR POSSIBLE DAMAGE TO BATTERY AND CLEAN BATTERY.	(1) LOOSE BATTERY POST, CRACKED BATTERY COVER OR CASE, LEAKS OR ANY OTHER PHYSICAL. (2) CLEAR EYE.	(1) REPLACE BATTERY (2) REPLACE BATTERY
BATTERY OPEN CIRCUIT VOLTAGE TEST	(1) BATTERY IS ABOVE 12.40 VOLTS (2) BATTERY IS BELOW 12.40 VOLTS.	(1) PERFORM THE BATTERY LOAD TEST. (2) PERFORM BATTERY CHARGING PROCEDURE
BATTERY CHARGED	(1) BATTERY ACCEPTED CHARGE. (2) BATTERY WILL NOT ACCEPT CHARGE	(1) PERFORM BATTERY OPEN CIRCUIT VOLTAGE TEST. (2) PERFORM CHARGING A COMPLETELY DISCHARGED BATTERY PROCEDURE.
BATTERY LOAD TEST	(1) ACCEPTABLE MINIMUM VOLTAGE. (2) UNACCEPTABLE MINIMUM VOLTAGE	(1) BATTERY IS OK TO PUT IN USE, PERFORM BATTERY IGNITION OFF DRAW TEST. (2) REPLACE BATTERY AND PERFORM BATTERY IGNITION OFF DRAW TEST.
CHARGING A COMPLETELY DISCHARGED BATTERY	(1) BATTERY ACCEPTED CHARGE. (2) BATTERY WILL NOT ACCEPT CHARGE.	(1) PERFORM BATTERY OPEN CIRCUIT VOLTAGE TEST. (2) REPLACE BATTERY.
IGNITION OFF DRAW TEST	(1) IOD IS 15-30 MILLIAMPERES. (2) IOD EXCEEDS 30 MILLIAMPERES.	(1) VEHICLE IS NORMAL. (2) ELIMINATE EXCESS IOD DRAW.

#### ABNORMAL BATTERY DISCHARGING

- Corroded battery posts, cables or terminals.
- Loose or worn generator drive belt.
- Electrical loads that exceed the output of the charging system due to equipment or accessories installed after delivery.
- Slow driving speeds in heavy traffic conditions or prolonged idling with high-amperage electrical systems in use.

- Defective electrical circuit or component causing excess Ignition Off Draw (IOD). Refer to Ignition Off Draw (IOD).
- Defective charging system.
- Defective battery.

#### BATTERY LOAD TEST

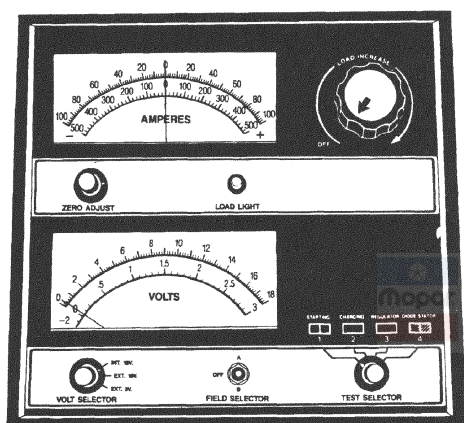
A fully charged battery must have cranking capacity. To provide the starter motor and ignition system enough power to start the engine over a broad range of ambient temperatures. A battery load test will verify the actual cranking capability of the battery.

**DIAGNOSIS AND TESTING (Continued)**

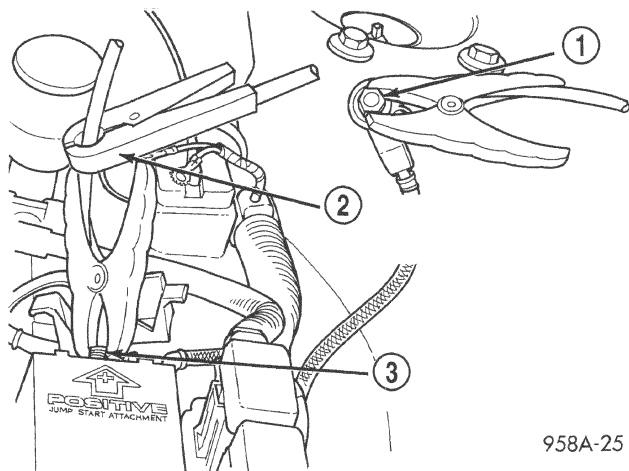
**WARNING: IF BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR EXCESSIVELY LOW ELECTROLYTE LEVEL, DO NOT TEST. ACID BURNS OR AN EXPLOSIVE CONDITION MAY RESULT.**

(1) Disconnect and isolate the battery negative remote cable first. Then disconnect and isolate the positive Jump Start cable.

(2) Use a suitable Volt/Ammeter/Load tester connected between remote battery terminals (Fig. 4) and (Fig. 5). Check the open circuit voltage of the battery. Voltage should be equal to or greater than 12.4 volts. If below 12.4 volts charge battery, perform the same test at the battery. Remove both battery cables the negative cable first. If the voltage is still below 12.4 perform Battery Charging procedures.



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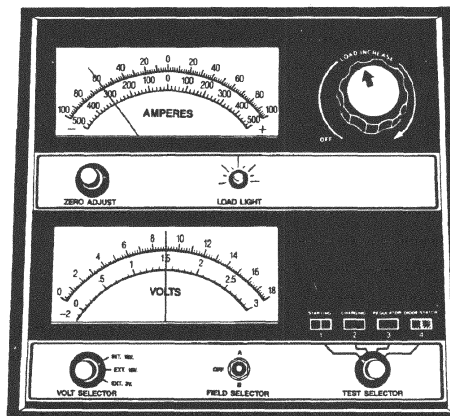
**Fig. 4 Volt-Ammeter-Load Tester**

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**Fig. 5 Volt-Ammeter-Load Tester Connections**

- 1 - NEGATIVE CLAMP
- 2 - INDUCTION AMPMETER CLAMP
- 3 - POSITIVE CLAMP

(3) Rotate the load control knob of the carbon pile rheostat to apply a 260 amp load. Apply this load for 15 seconds to remove the surface charge from the battery, and return the control knob to off (Fig. 6).

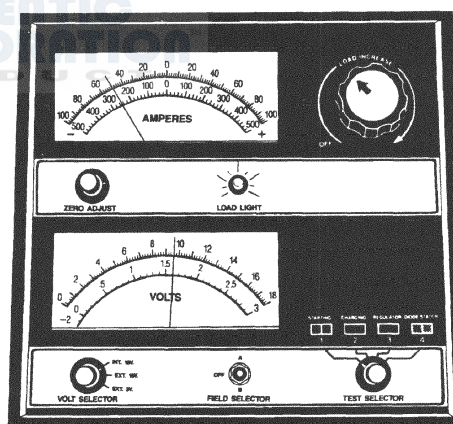


898A-10

**Fig. 6 Remove Surface Charge from Battery**

(4) Allow the battery to stabilize for two minutes, and then verify open circuit voltage.

(5) Rotate the load control knob on the tester to maintain 50% (260) of the battery cold crank rating for a minimum 15 seconds (Fig. 7).



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**Fig. 7 Load 50% Cold Crank Rating**

(6) After 15 seconds, record the loaded voltage reading and return the load control to off.

(7) Voltage drop will vary according to battery temperature at the time of the load test. Battery temperature can be estimated by the temperature of exposure over the preceding several hours. If the battery has been charged, boosted, or loaded a few minutes prior to the test, the battery would be slightly warmer. Refer to Battery Load Test Temperatures Table for proper loaded voltage reading.

(8) If battery passes load test, it is in good condition and further tests are not necessary. If it fails load test, it should be replaced.



**DIAGNOSIS AND TESTING (Continued)****BATTERY LOAD TEMPERATURE TABLE**

Minimum Voltage	Temperature	
	°F	°C
9.6 volts	70° and above	21° and above
9.5 volts	60°	16°
9.4 volts	50°	10°
9.3 volts	40°	4°
9.1 volts	30°	-1°
8.9 volts	20°	-7°
8.7 volts	10°	-12°
8.5 volts	0°	-18°

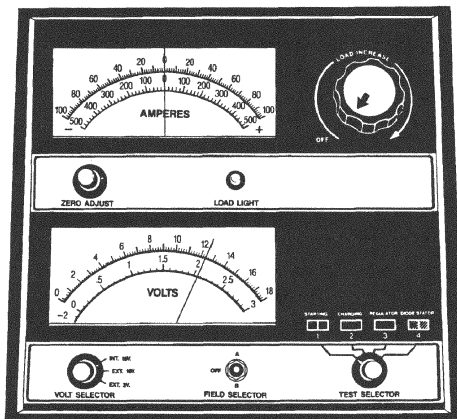
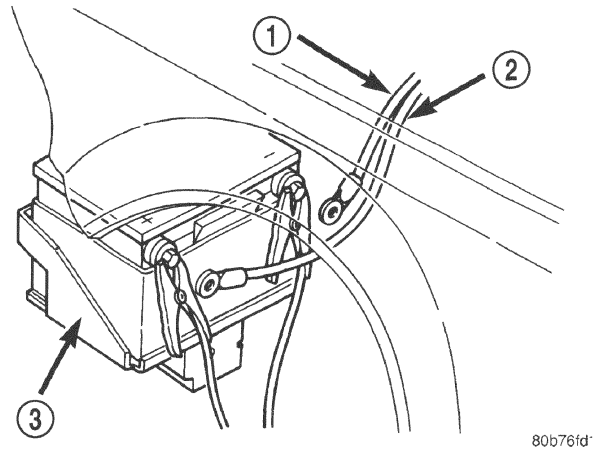
**BATTERY OPEN CIRCUIT VOLTAGE TEST**

An open circuit voltage no load test shows the state of charge of a battery and whether it is ready for a load test at 50 percent of the battery's cold crank rating. Refer to Battery Load Test. If a battery has open circuit voltage reading of 12.4 volts or greater, and will not pass the load test, replace the battery because it is defective. To test open circuit voltage, perform the following operation.

(1) Remove both battery cables, negative cable first. Connect a Volt/Ammeter/Load tester (Fig. 8) to the battery posts (Fig. 9).

(2) Allow the battery to stabilize for 2 minutes, and then verify the open circuit voltage. Refer to Battery Open Circuit Voltage table.

(3) This voltage reading will approximate the state of charge of the battery. It will not reveal battery cranking capacity.

**Fig. 8 Testing Open Circuit Voltage****Fig. 9 Volt-Ammeter Load Tester Connections**

- 1 - BATTERY NEGATIVE CABLE
- 2 - BATTERY POSITIVE CABLE
- 3 - BATTERY

**BATTERY OPEN CIRCUIT VOLTAGE**

Open Circuit Volts	Charge Percentage
11.7 volts or less	0%
12.0 volts	25%
12.2 volts	50%
12.4 volts	75%
12.6 volts or more	100%

**IGNITION OFF DRAW TESTS (IOD)**

High battery current draw when the ignition switch in the off position will discharge a battery. After a dead battery is serviced, the vehicle Ignition Off Draw (IOD) should be checked. To determine if a high current draw condition exists, check the vehicle with a Digital multimeter that has an ammeter range from at least 10 amps down to 10 milliamps (30) milliamps is allowable.

(1) Verify all electrical accessories are OFF:

- Remove key from ignition switch
- Turn off all lamps
- Trunk compartment lamp is disconnected or removed
- Glove box lamp goes off when the door is closed
- All doors are closed
- Sun visor vanity lamps are OFF

(2) Disconnect battery negative remote cable.

**CAUTION:** Do not operate any accessory that has a greater draw than the ammeter can measure.



## DIAGNOSIS AND TESTING (Continued)

(3) Using a Digital multi-meter, set to 10 amps and connect leads between the battery negative remote terminal and the battery negative remote cable stud.

(a) Remove the "Seat Belt" (20 amp max) AND the "EATX" (20 amp min) fuses from the PDC.

(b) Wait (1) minute.

(c) If the reading is greater than 30 milliamps, go to HIGH MILLIAMP READING.

(d) Reinstall the EATX fuse.

(e) If the draw increases, remove the fuse again and immediately reinstall the fuse. If the draw increases again, repeat the remove and install process (2) or (3) times. If the draw continues to increase, it will be necessary to wait for up to (20) minutes to see if the draw drops. If it does not, the problem will be in the EATX module or circuit.

(f) If the draw remains under (30) milliamps, there is not a problem with an "Ignition Off Draw". If the draw did increase, it will be necessary to wait for (30) minutes. If it does not, the problem might be with the SCTM or seat belt circuit. Verify SCTM time-out.

(g) To enable the SCTM to time-out in (30) seconds, perform the following:

- (4) key cycles within (4) seconds.
- Pull radio fuse if RAZ radio equipped (Integrated CD and Cassette). The diagnostic mode will reflect an unlocked seat belt if the doors are open (door ajar switch closed), and a locked seat belt condition if the doors are closed (door ajar switch open).

**NOTE: Each time the ammeter is disconnected and reconnected, all electronic timer functions will be reactivated.**

### HIGH MILLIAMPERE READING

**NOTE: Perform BATTERY IGNITION OFF DRAW TEST before proceeding.**

If the IOD is high, there is either a short circuit or a fault in an electronic module. There are (6) other fuses in the Power Distribution Center and Junction Block that feed the modules with ignition off draw.

Ensure that all electronic timer functions are timed out before testing any of the components.

### IN THE POWER DISTRIBUTION CENTER

- Ignition Fuel Starter (20 Amp)
- Hazard Flasher (20 Amp)
- EATX (20 Amp min) (previously tested)
- Seat Belt (20 Amp max) (previously tested)
- Stop Lamp (20 Amp)

### IN THE JUNCTION BLOCK:

- Daytime Running Lamps (DRL) (20 Amp)
- Horns-Cigar Lighter (20 Amp)
- Interior lamps (10 Amp) (IOD)
- Park/tail lamps-Instrument Cluster (20 Amp)

**NOTE: Do not operate any accessory that has a greater draw than the installed ammeter can measure.**

Replace fuses one at a time. The module should draw a few milliamps when the fuse is replaced. If it draws in excess of (20) milliamps (not including timed out functions) then the module should be replaced or wiring should be investigated. Refer to Group 8W-Wiring Diagrams. Check for faulty systems operations or module fault codes to help find wiring faults. Be sure you have double checked other possible IOD draws. Refer to IOD Draw Table.

**IOD DRAW TABLE**

COMPONENT	AMPERAGE DRAW
STUCK RELAY	0.25 AMP
ILLUMINATED BULB	0.25 - 1 AMP
RADIO MEMORY	1 - 4 ma
BCM	8 ma (TIMED OUT)
TRUNK SOLENOID STUCK ON	0.5 AMP

To determine if a module draw is within acceptable range, refer to the Module Amperage Table for IOD readings.

**DIAGNOSIS AND TESTING (Continued)****MODULE AMPERAGE TABLE**

FUSE NO.	MODULE	INITIALIZER	TIMEOUT	DRAW DURING TIMEOUT	DRAW AFTER TIMEOUT
#4	BCM - LAMPS	RKE, DOOR AJAR, IGNITION KEY ON	0.5 MIN.	3.0 AMPS	0
#5 & #10	PCM	IGNITION KEY ON	0.5 MIN.	UP TO 4 AMPS	1.3 ma
#4	BCM - MICRO-PROCESSOR	DOOR AJAR, IGNITION KEY ON	1 MIN.	60 ma	7 ma
#6	SKIM	IGNITION KEY ON	5 MIN.	60 ma	7 ma
#3	EATX	IGNITION KEY ON	20 MIN.	60 ma	0.8 ma
#13	SCTM	DOOR AJAR, IGNITION KEY TURNED FROM RUN OR ACCESSORY TO OFF	30 MIN.	400 ma	1.5 ma

NOTE: MAKE SURE DOOR IS CLOSED WHEN CHECKING BCM AND LAMPS. DOOR AJAR SWITCHES WILL KEEP BCM FROM TIMING OUT.

**NOTE:** To check to see if SCTM is initialized, pull on the seat belt and if it is locked the module is not initialized or "Awake".

- It has an open circuit voltage charge of at least 12.4 volts (refer to Battery Open Circuit Voltage table).

- It passes the 15 second load test, refer to Battery Load Test Temperatures Table.

**SERVICE PROCEDURES****SAFETY PRECAUTIONS AND WARNINGS**

**WARNING:** WEAR SAFETY GLASSES.

DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE.

DO NOT USE OPEN FLAME NEAR BATTERY.

REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT.

WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW THE DISABLED VEHICLE'S BATTERY TO EXCEED 16 VOLTS. PERSONAL INJURY OR DAMAGE TO ELECTRICAL SYSTEM CAN RESULT.

TO PROTECT THE HANDS FROM BATTERY ACID, A SUITABLE PAIR OF HEAVY DUTY RUBBER GLOVES, NOT THE HOUSEHOLD TYPE, SHOULD BE WORN WHEN REMOVING OR SERVICING A BATTERY. SAFETY GLASSES ALSO SHOULD BE WORN.

**BATTERY CHARGING**

A battery is considered fully charged when it will meet all the following requirements.

**WARNING:** DO NOT ASSIST BOOST OR CHARGE A FROZEN BATTERY.

**EXPLOSIVE GASES FORM OVER THE BATTERY, DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR BATTERY.**

**CAUTION:** Disconnect the battery **NEGATIVE** cable first, before charging battery to avoid damage to electrical systems. Do not exceed 16.0 volts while charging battery. Refer to the instructions supplied with charging equipment.

Battery electrolyte will bubble inside of battery case while being charged properly. If the electrolyte boils violently, or is discharged from the vent holes while charging, immediately reduce charging rate or turn off charger. Evaluate battery condition. Battery damage may occur if charging is excessive.

Some battery chargers are equipped with polarity sensing devices to protect the charger or battery from being damaged if improperly connected. If the battery state of charge is too low for the polarity sensor to detect, the sensor must be bypassed for charger to operate. Refer to operating instructions provided with battery charger being used.

**CAUTION:** Do not overcharge Battery. Refer to Battery Charging Rate table.

SERVICE PROCEDURES (Continued)

After the battery has been charged to 12.4 volts or greater, perform a load test to determine cranking capacity. Refer to Battery Load Test in this Group. If the battery will endure a load test, return the battery to use. If battery will not endure a load test, it must be replaced. Properly clean and inspect battery hold downs, tray, terminals, cables, posts, and top before completing service.

BATTERY CHARGING TIME REQUIRED

**WARNING: NEVER EXCEED 20 AMPS WHEN CHARGING A COLD -1°C (30°F) BATTERY. PERSONAL INJURY MAY RESULT.**

The time required to charge a battery will vary depending upon the following factors.

SIZE OF BATTERY

A completely discharged large heavy-duty battery may require more recharging time than a completely discharged small capacity battery, refer to Battery Charging Timetable for charging times.

BATTERY CHARGING TIMETABLE

CHARGING AMPERAGE	5 AMPERES	10 AMPERES	20 AMPERES
OPEN CIRCUIT VOLTAGE	HOURS CHARGING AT 21° C (70° F)		
12.25 TO 12.49	6 HOURS	3 HOURS	1.5 HOURS
12.00 TO 12.24	10 HOURS	5 HOURS	2.5 HOURS
10.00 TO 11.99	14 HOURS	7 HOURS	3.5 HOURS
*BELOW 10.00	18 HOURS	9 HOURS	4.5 HOURS
*REFER TO CHARGING A COMPLETELY DISCHARGED BATTERY			

TEMPERATURE

A longer time will be needed to charge a battery at -18°C (0°F) than at 27°C (80°F). When a fast charger is connected to a cold battery, current accepted by battery will be very low at first. In time, the battery will accept a higher rate as battery temperature warms.

CHARGER CAPACITY

A charger which can supply only five amperes will require a much longer period of charging than a charger that can supply 20 amperes or more.

STATE OF CHARGE

A completely discharged battery requires more charging time than a partially charged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current amperage will be low. As water is converted back to sulfuric acid inside the battery, the current amp rate will rise. Also, the specific gravity of the electrolyte will rise. Refer to Battery Charging procedures.

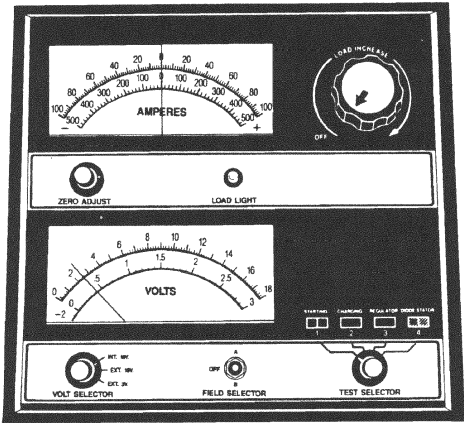
CHARGING COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless procedure is properly followed, a good battery may be needlessly replaced. Refer to Battery Charging Rate table for correct charge times.

BATTERY CHARGING RATE

Voltage	Hours
16.0 volts maximum	up to 4 hours
14.0 to 15.9 volts	up to 8 hours
13.9 volts or less	up to 16 hours

(1) Measure the voltage at remote cable terminals with a voltmeter accurate to 1/10 volt (Fig. 10). If below 10 volts, charge current will be low, and it could take some time before it accepts a current in excess of a few milliamperes. Such low current may not be detectable on amp meters built into many chargers.



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Fig. 10 Voltmeter Accurate to 1/10 Volt (Connected)



## SERVICE PROCEDURES (Continued)

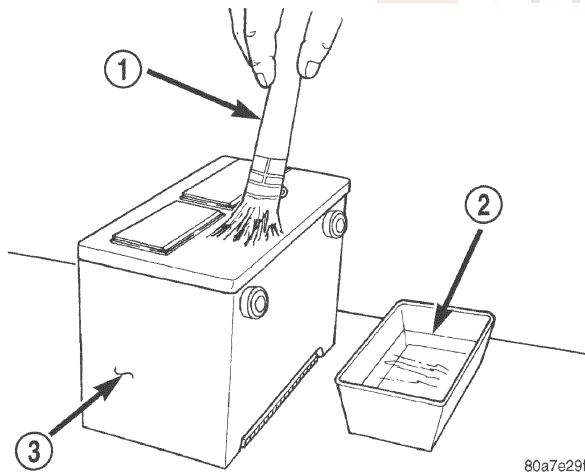
(2) Connect charger leads to the remote cables. Some chargers feature polarity protection circuitry that prevents operation unless charger is connected to battery posts correctly. A completely discharged battery may not have enough voltage to activate this circuitry. This may happen even though the leads are connected properly.

(3) Battery chargers vary in the amount of voltage and current they provide. For the time required for the battery to accept measurable charger current at various voltages, refer to Battery Charging Rate table. If charge current is still not measurable after charging times, the battery should be replaced. If charge current is measurable during charging time, the battery may be good, and charging should be completed in the normal manner.

## VISUAL INSPECTION AND SERVICE

**CAUTION:** Do not allow baking soda solution to enter vent holes, as damage to battery can result.

(1) Clean battery with a solution of warm water and baking soda. Apply solution with a bristle brush and allow to soak until acid deposits loosen (Fig. 11). Rinse with clear water and blot dry with paper toweling. Dispose of toweling in a safe manner. Refer to the WARNINGS on top of battery.



**Fig. 11 Cleaning Battery**

- 1 - CLEANING BRUSH
- 2 - WARM WATER AND BAKING SODA SOLUTION
- 3 - BATTERY

(2) Inspect battery case and cover for cracks or leakage. If leakage is present battery must be replaced.

(3) Inspect battery tray for damage caused by acid from battery. If acid damage is present, it will be necessary to clean area with:

- Baking soda solution
- Wire brush
- Scraper

(4) Clean battery terminals with baking soda and suitable cleaning tool.

(5) Inspect cables for damage and broken terminals. Replace damaged, frayed cables and broken terminal.

(6) Inspect battery for proper or damaged hold down ledge.

## REMOVAL AND INSTALLATION

### SAFETY PRECAUTIONS AND WARNINGS

**WARNING: WEAR SAFETY GLASSES.**

**DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE.**

**DO NOT USE OPEN FLAME NEAR BATTERY.**

**REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT.**

**WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW THE DISABLED VEHICLE'S BATTERY TO EXCEED 16 VOLTS. PERSONAL INJURY OR DAMAGE TO ELECTRICAL SYSTEM CAN RESULT.**

**TO PROTECT THE HANDS FROM BATTERY ACID, A SUITABLE PAIR OF HEAVY DUTY RUBBER GLOVES, NOT THE HOUSEHOLD TYPE, SHOULD BE WORN WHEN REMOVING OR SERVICING A BATTERY. SAFETY GLASSES ALSO SHOULD BE WORN.**

## BATTERY

### REMOVAL

**The Battery is accessible without removing the Wheel and Tire assembly.**

(1) Make sure ignition switch is in OFF UNLOCKED position and all accessories are OFF.

**WARNING: NEVER GET UNDER A LIFTED VEHICLE IF NOT SUPPORTED PROPERLY ON SAFETY STANDS.**

**REMOVAL AND INSTALLATION (Continued)**

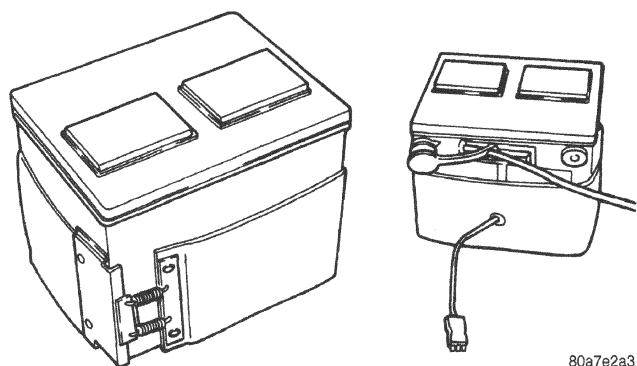
(2) Disconnect battery negative cable from remote negative terminal on left shock tower.

(3) Turn steering wheel to the **FULL LEFT** position.

(4) Twist the four plastic screws one quarter turn to release shield.

(5) Remove shield.

(6) Disconnect battery blanket heater cord, if equipped (Fig. 12).



**Fig. 12 Battery with Blanket Heater**

(7) Remove battery negative cable followed by the battery positive cable.

(8) Remove bolt attaching the battery strap to the battery hold down bracket. Remove hold down bracket bolt.

(9) Slide battery to rear of tray and lift over lip. Use care not to tip battery so that the acid will not spill out.

(10) Remove battery.

(11) Remove battery blanket heater if equipped (Fig. 12).

**INSTALLATION**

For installation, reverse the above procedures. Tighten battery cables to 16 N·m (150 in. lbs.) torque.

**BATTERY TRAY****REMOVAL**

(1) Remove battery, refer to Battery Removal procedures above.

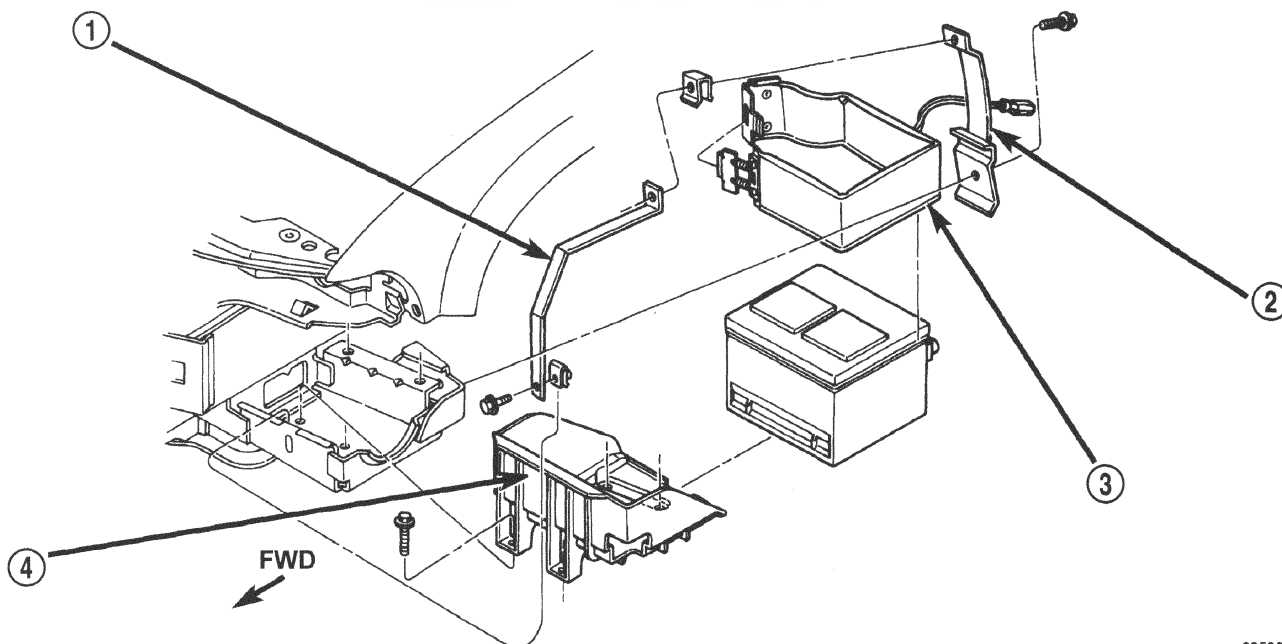
(2) Remove the battery tray attaching bolts (Fig. 13).

(3) Remove battery tray.

(4) Remove battery strap.

**INSTALLATION**

For installation, reverse the above procedures.



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**Fig. 13 Battery Tray Removal**

- 1 - BATTERY STRAP
- 2 - RETAINER STRAP
- 3 - BATTERY BLANKET HEATER

- 4 - FWD
- 5 - BATTERY TRAY

SPECIFICATIONS

BATTERY SPECIFICATIONS

Load Test	Cold Cranking	Reserve
(Amps)	Rating @ -18°C (0°F)	Capacity
260 Amp	510 Amp	110 Minutes

COLD CRANK RATING

The current battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at -18° C (0° F).

RESERVE CAPACITY RATING

The length of time a battery can deliver 25 amps and maintain a minimum terminal voltage of 10.5 volts at 27°C (80°F).

TORQUE

DESCRIPTION	TORQUE
Battery Hold Down Bolt Clamp Bolt . . . . .	14 N·m (160 in. lbs.)





# STARTING SYSTEMS

## TABLE OF CONTENTS

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## DESCRIPTION AND OPERATION

### STARTER

#### DESCRIPTION

##### BOSCH AND MELCO STARTERS

The Bosch and Melco are permanent magnet starter motors. A planetary gear train transmits power between starter motor and pinion shaft. The fields have six permanent magnets. The Bosch is used on 2.0L engines and Melco is used on 2.5L engines.

##### NIPPONDENSO STARTER

The Nippondenso is a reduction gear-field coil starter motor and is available on 2.4L engine.

#### OPERATION

The starting system has:

- Ignition switch
- Starter relay
- Clutch Pedal Position Switch with manual transmissions
- Powertrain Control Module (PCM)
- Wiring harness
- Battery
- Starter motor with an integral solenoid

These components form two separate circuits. A high amperage circuit that feeds the starter motor up to 300+ amps, and a control circuit that controls the starter solenoid and operates on less than 20 amps.

The Powertrain Control Module (PCM) controls a double start over ride safety that does not allow the starter to be engaged if the engine is already running.

## DIAGNOSIS AND TESTING

### CONTROL CIRCUIT TEST

The starter control circuit has:

- Starter solenoid
- Starter relay
- Transmission range sensor, or Park/Neutral Position switch with automatic transmissions
- Clutch Pedal Position Switch with manual transmissions
- Ignition switch
- Battery
- All related wiring and connections

**CAUTION:** Before performing any starter tests, the ignition and fuel systems must be disabled.

• To disable ignition and fuel systems, disconnect the Automatic Shutdown Relay (ASD). The ASD relay is located in the Power Distribution Center (PDC). Refer to the PDC cover for the proper relay location.

### STARTER SOLENOID

**WARNING:** CHECK TO ENSURE THAT THE TRANSMISSION IS IN THE PARK POSITION WITH THE PARKING BRAKE APPLIED

(1) Verify battery condition. Battery must be in good condition with a full charge before performing any starter tests. Refer to Battery Tests.

(2) Perform Starter Solenoid test BEFORE performing the starter relay test.

(3) Raise the vehicle.

(4) Perform a visual inspection of the starter/ starter solenoid for corrosion, loose connections or faulty wiring.

(5) Lower the vehicle.

## DIAGNOSIS AND TESTING (Continued)

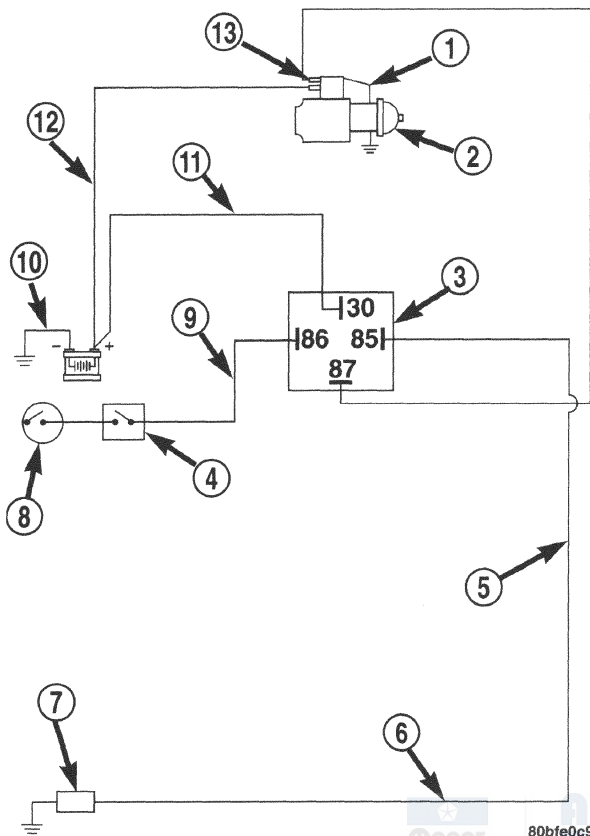


Fig. 1 Starting System Schematic

- 1 - STARTER SOLENOID
- 2 - STARTER MOTOR
- 3 - STARTER RELAY CONNECTOR
- 4 - CLUTCH PEDAL POSITION SWITCH (MAN. TRANS. ONLY)
- 5 - GROUND CIRCUIT
- 6 - THIS CIRCUIT GROUNDED AT ALL TIMES (MAN. TRANS. ONLY)
- 7 - POWERTRAIN CONTROL MODULE
- 8 - IGNITION SWITCH
- 9 - IGNITION FEED
- 10 - NEGATIVE CABLE
- 11 - BATTERY RELAY FEED
- 12 - POSITIVE CABLE
- 13 - SOLENOID TERMINAL

(6) Locate and remove the starter relay from the Power Distribution Center (PDC). Refer to the PDC label for relay identification and location.

(7) Connect a remote starter switch or a jumper wire between the remote battery positive post and terminal 87 of the starter relay connector.

(a) If engine cranks, starter/starter solenoid is good. Go to the Starter Relay Test.

(b) If engine does not crank or solenoid chatters, check wiring and connectors from starter relay to starter solenoid for loose or corroded connections. Particularly at starter terminals.

(c) Repeat test. If engine still fails to crank properly, trouble is within starter or starter mounted solenoid, and replace starter.

## STARTER RELAY

**WARNING: CHECK TO ENSURE THAT THE TRANSMISSION IS IN THE PARK POSITION/NEUTRAL WITH THE PARKING BRAKE APPLIED**

## RELAY TEST

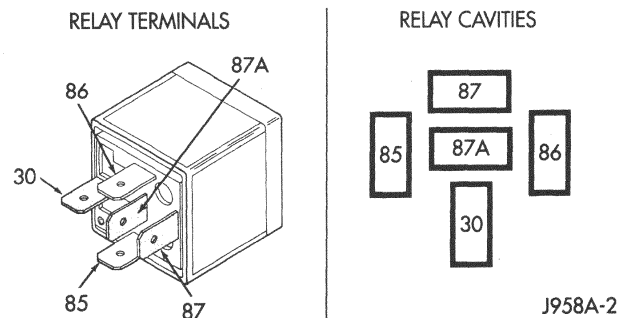
The starter relay is located in the Power Distribution Center (PDC) in the engine compartment. Refer to the PDC label for relay identification and location.

Remove the starter relay from the PDC as described in this group to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be  $75 \pm 5$  ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery B+ lead to terminals 86 and a ground lead to terminal 85 to energize the relay. The relay should click. Also test for continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, refer to Relay Circuit Test procedure. If not OK, replace the faulty relay.



## TERMINAL LEGEND

NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

## Starter Relay

## RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all

## DIAGNOSIS AND TESTING (Continued)

times. If OK, go to Step 2. If not OK, repair the open circuit to the PDC fuse as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the starter solenoid field coils. There should be continuity between the cavity for relay terminal 87 and the starter solenoid terminal at all times. If OK, go to Step 4. If not OK, repair the open circuit to the starter solenoid as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is energized when the ignition switch is held in the Start position. On vehicles with a manual transmission, the clutch pedal must be fully depressed for this test. Check for battery voltage at the cavity for relay terminal 86 with the ignition switch in the Start position, and no voltage when the ignition switch is released to the On position. If OK, go to Step 5. If not OK with an automatic transmission, check for an open or short circuit to the ignition switch and repair, if required. If the circuit to the ignition switch is OK, see the Ignition Switch Test procedure in this group. If not OK with a manual transmission, check the circuit between the relay and the clutch pedal position switch for an open or a short. If the circuit is OK, see the Clutch Pedal Position Switch Test procedure in this group.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. On vehicles with an automatic transmission, it is grounded through the park/neutral position switch only when the gearshift selector lever is in the Park or Neutral positions. On vehicles with a manual transmission, it is grounded at all times. Check for continuity to ground at the cavity for relay terminal 85. If not OK with an automatic transmission, check for an open or short circuit to the park/neutral position switch and repair, if required. If the circuit is OK, see the Park/Neutral Position Switch Test procedure in this group. If not OK with a manual transmission, repair the circuit to ground as required.

## SAFETY SWITCHES

For diagnostics,

- Clutch Pedal Position Switch, refer to Group 6, Clutch.
- Park/Neutral Position Switch, refer to Group 21, Transaxle

## IGNITION SWITCH

After testing starter solenoid and relay, test ignition switch and wiring. Refer to Group 8D, Ignition

Systems or Group 8W, Wiring Diagrams. Check all wiring for opens or shorts, and all connectors for being loose or corroded.

## BATTERY

Refer to Group 8A, Battery for proper procedures.

## ALL RELATED WIRING AND CONNECTORS

Refer to Group 8W, Wiring Diagrams,

## FEED CIRCUIT RESISTANCE TEST

Before proceeding with this operation, review Starting System Test. The following operation will require a voltmeter, accurate to one tenth of a volt.

**CAUTION: Before Performing any starter test, the Ignition and fuel systems must be disabled.**

(1) To disable ignition and fuel systems disconnect the Automatic Shutdown Relay (ASD) in the Power Distribution Center (PDC).

(2) Check that all wiring harnesses and components properly connected. Connect negative lead of voltmeter to battery negative terminal, and positive lead to engine block near the battery cable attaching point (Fig. 2). Rotate and hold the ignition switch in the START position. If voltage reads above 0.2 volt, clean or repair the poor contact at ground cable attaching points. If voltage reading is still above 0.2 volt after correcting poor contacts, replace ground cable.

(3) Connect the positive voltmeter lead to the battery positive terminal, and negative lead to battery positive cable terminal on starter solenoid (Fig. 3). Rotate and hold the ignition switch in the START position. If voltage reads above 0.2 volt, clean or repair the poor contact at:

- Battery cable to solenoid connection
- Battery cable to remote terminal
- Battery cable to battery

If reading is still above 0.2 volt after correcting poor contacts, replace battery positive cable as necessary.

(4) If resistance tests do not detect feed circuit failures, replace starter motor.

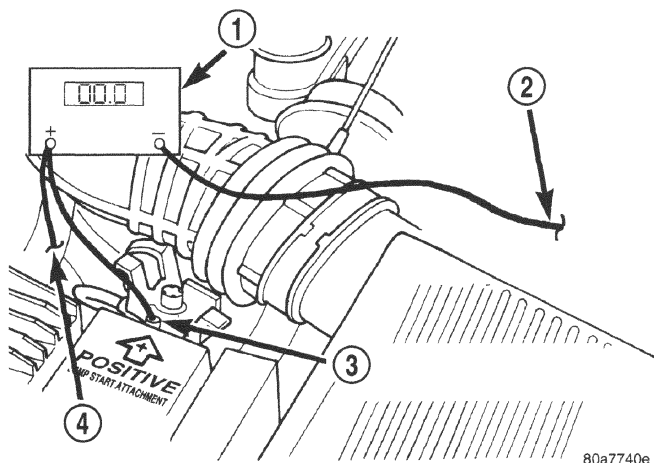
## FEED CIRCUIT TEST

The following procedure will require a suitable volt-ampere tester (Fig. 4).

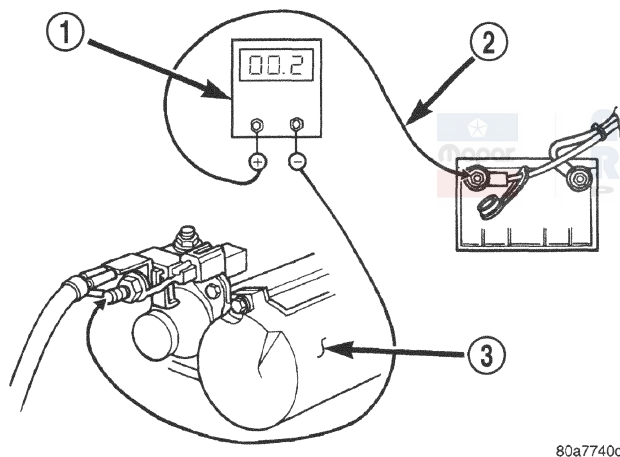
**CAUTION: Before Performing any starter test, the Ignition and fuel systems must be disabled.**

(1) Connect a volt-ampere tester (Fig. 4) to the remote battery terminals (Fig. 5). Refer to the operating instructions provided with the tester being used.



**DIAGNOSIS AND TESTING (Continued)****Fig. 2 Test Ground Circuit Resistance**

- 1 - VOLTMETER
- 2 - ATTACH TO BATTERY NEGATIVE SIDE TERMINAL
- 3 - BATTERY POSITIVE REMOTE CABLE
- 4 - TO ENGINE GROUND

**Fig. 3 Test Battery Positive Cable Resistance**

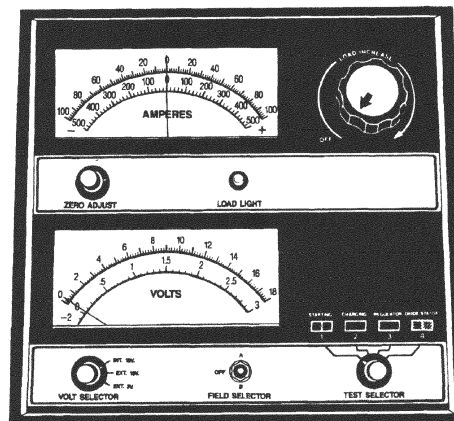
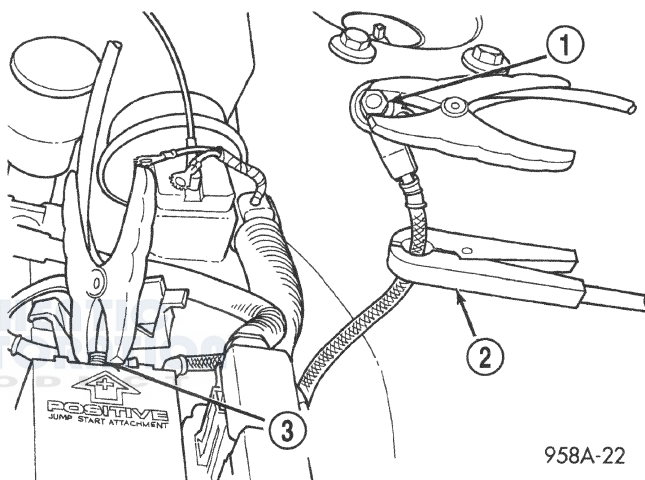
- 1 - VOLTMETER
- 2 - TO BATTERY POSITIVE SIDE TERMINAL
- 3 - STARTER MOTOR

(2) To disable the ignition and fuel systems, disconnect the Automatic Shutdown Relay (ASD) in the Power Distribution Center (PDC). Refer to the PDC cover for the proper relay location.

(3) Verify that:

- All lamps and accessories are OFF
- Automatic transmission shift selector is in PARK
- Manual transmission clutch pedal depressed
- Set parking brake

(4) Rotate and hold the ignition switch in the START position. Observe the volt-ampere tester (Fig. 4).

**Fig. 4 Volt Ampere Tester****Fig. 5 Volt-Ampere Tester Connections**

- 1 - NEGATIVE CLAMP
- 2 - INDUCTION AMPMETER CLAMP
- 3 - POSITIVE CLAMP

- Voltage above 9.6 volts, and amperage draw above 280 amps, check for engine seizing or faulty starter.

- Voltage above 12.4 volts and amperage reads 0 to 10 amps, check for corroded cables and/or bad connections.

- Voltage below 9.6 volts and amperage draw above 300 amps, the problem is the starter. Replace the starter refer to starter removal.

**CAUTION: Do not overheat the starter motor or draw the battery voltage below 9.6 volts during cranking operations.**

(5) After the starting system problems have been corrected, verify the battery state-of-charge and charge battery if necessary. Disconnect all testing equipment and connect ASD relay. Start the vehicle several times to assure the problem has been corrected.

## DIAGNOSIS AND TESTING (Continued)

### STARTING SYSTEM TEST

For circuit descriptions and diagrams, refer to 8W-21, Starting System in Group 8W, Wiring Diagrams.

**WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**

### INSPECTION

Before removing any unit from the starting system for repair or diagnosis, perform the following inspections:

- **Battery** - Visually inspect the battery for indications of physical damage and loose or corroded cable connections. Determine the state-of-charge and cranking capacity of the battery. Charge or replace the battery, if required. Refer to Group 8A, Battery for more information.
- **Ignition Switch** - Visually inspect the ignition switch for indications of physical damage and loose or corroded wire harness connections.

- **Clutch Pedal Position Switch** - Visually inspect the clutch pedal position switch for indications of physical damage and loose or corroded wire harness connections.

- **Park/Neutral Position Switch** - Visually inspect the park/neutral position switch for indications of physical damage and loose or corroded wire harness connections.

- **Starter Relay** - Visually inspect the starter relay for indications of physical damage and loose or corroded wire harness connections.

- **Starter** - Visually inspect the starter for indications of physical damage and loose or corroded wire harness connections.

- **Starter Solenoid** - Visually inspect the starter solenoid for indications of physical damage and loose or corroded wire harness connections.

- **Wiring** - Visually inspect the wire harness for damage. Repair or replace any faulty wiring, as required. Check for loose or corroded wire harness connections at main engine ground.

- **Power Distribution Center (PDC)** Visually inspect the B+ connections at the PDC for physical damage and loose or corroded harness connections.

### STARTING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER FAILS TO ENGAGE.	1. BATTERY DISCHARGED OR FAULTY. 2. STARTING CIRCUIT WIRING FAULTY. 3. STARTER RELAY FAULTY. 4. IGNITION SWITCH FAULTY. 5. PARK/NEUTRAL POSITION SWITCH (AUTO TRANS) FAULTY OR MIS-ADJUSTED. 6. CLUTCH PEDAL POSITION SWITCH (MAN TRANS) FAULTY. 7. STARTER SOLENOID FAULTY. 8. STARTER ASSEMBLY FAULTY.	1. REFER TO GROUP 8A, BATTERY. CHARGE OR REPLACE BATTERY, IF REQUIRED. 2. REFER TO FEED CIRCUIT RESISTANCE TEST AND FEED CIRCUIT TEST IN THIS SECTION. 3. REFER TO RELAY TEST, IN THIS SECTION. REPLACE RELAY, IF NECESSARY. 4. REFER TO IGNITION SWITCH TEST, IN GROUP 8D IGNITION SYSTEM OR GROUP 8W, WIRING DIAGRAMS. REPLACE SWITCH, IF NECESSARY. 5. REFER PARK/NEUTRAL POSITION SWITCH TEST, IN GROUP 21, TRANSAXLE. REPLACE SWITCH, IF NECESSARY. 6. REFER TO CLUTCH PEDAL POSITION SWITCH TEST, IN GROUP 6, CLUTCH. REPLACE SWITCH, IF NECESSARY. 7. REFER TO SOLENOID TEST, IN THIS SECTION. REPLACE STARTER ASSEMBLY, IF NECESSARY. 8. IF ALL OTHER STARTING SYSTEM COMPONENTS AND CIRCUITS CHECK OK, REPLACE STARTER ASSEMBLY.

**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER ENGAGES, FAILS TO TURN ENGINE.	<ol style="list-style-type: none"> <li>1. BATTERY DISCHARGED OR FAULTY.</li> <li>2. STARTING CIRCUIT WIRING FAULTY.</li> <li>3. STARTER ASSEMBLY FAULTY.</li> <li>4. ENGINE SEIZED.</li> <li>5. LOOSE CONNECTION AT BATTERY, PDC, STARTER, OR ENGINE GROUND.</li> </ol>	<ol style="list-style-type: none"> <li>1. REFER TO GROUP 8A, BATTERY. CHARGE OR REPLACE BATTERY AS NECESSARY.</li> <li>2. REFER TO THE FEED CIRCUIT RESISTANCE TEST AND THE FEED CIRCUIT TEST IN THIS SECTION. REPAIR AS NECESSARY.</li> <li>3. IF ALL OTHER STARTING SYSTEM COMPONENTS AND CIRCUITS CHECK OK, REPLACE STARTER ASSEMBLY.</li> <li>4. REFER TO GROUP 9 ENGINE, FOR DIAGNOSTIC AND SERVICE PROCEDURES.</li> <li>5. INSPECT FOR LOOSE CONNECTIONS.</li> </ol>
STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS.	<ol style="list-style-type: none"> <li>1. BROKEN TEETH ON STARTER RING GEAR.</li> <li>2. STARTER ASSEMBLY FAULTY.</li> </ol>	<ol style="list-style-type: none"> <li>1. REMOVE STARTER. INSPECT RING GEAR AND REPLACE IF NECESSARY.</li> <li>2. IF ALL OTHER STARTING SYSTEM COMPONENTS AND CIRCUITS CHECK OK, REPLACE STARTER ASSEMBLY.</li> </ol>
STARTER DOES NOT DISENGAGE.	<ol style="list-style-type: none"> <li>1. STARTER IMPROPERLY INSTALLED.</li> <li>2. STARTER RELAY FAULTY.</li> <li>3. IGNITION SWITCH FAULTY.</li> <li>4. STARTER ASSEMBLY FAULTY.</li> <li>5. FAULTY TEETH ON RING GEAR.</li> </ol>	<ol style="list-style-type: none"> <li>1. INSTALL STARTER. TIGHTEN STARTER MOUNTING HARDWARE TO CORRECT TORQUE SPECIFICATIONS.</li> <li>2. REFER TO RELAY TEST, IN THIS SECTION. REPLACE RELAY, IF NECESSARY.</li> <li>3. REFER TO IGNITION SWITCH TEST, IN GROUP 8D, IGNITION SYSTEM. REPLACE SWITCH, IF NECESSARY.</li> <li>4. IF ALL OTHER STARTING SYSTEM COMPONENTS AND CIRCUITS CHECK OK, REPLACE STARTER ASSEMBLY.</li> <li>5. ROTATE FLYWHEEL 360°, AND INSPECT TEETH.</li> </ol>

**REMOVAL AND INSTALLATION****SAFETY SWITCHES**

For Removal and Installation of the:

- Clutch Position Switch, refer to Group 6, Clutch.
- Park/Neutral Switch, refer to Group 21, Transaxle.

**STARTER**

**CAUTION:** The generator output terminal must be connected to the battery positive terminal of the starter solenoid. For the charging and cranking systems to operate properly.

**2.0L ENGINE WITH MANUAL TRANSAXLE****REMOVAL**

- (1) Disconnect the remote battery negative cable from the terminal on shock tower (Fig. 6).
- (2) Remove air cleaner resonator, refer to Group 14, Fuel.

- (3) Remove the battery positive cable nut from starter. Remove battery positive cable and generator output wire from starter (Fig. 7).

- (4) Disconnect push on solenoid connector. Unlock the red locking tab and compress lock to release the connector.

- (5) Remove two bolts attaching starter to transmission housing and remove starter from vehicle.

**INSTALLATION**

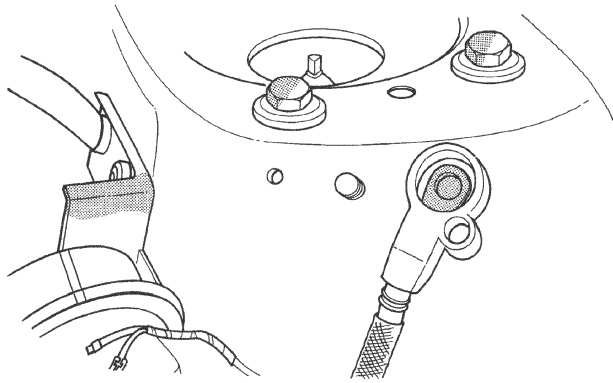
For installation, reverse the above procedures. Clean corrosion/dirt from wire terminals before installing wiring to the solenoid.

**2.0L ENGINE WITH AUTOMATIC TRANSAXLE AND 2.4L ENGINE****REMOVAL**

- (1) Disconnect battery negative cable from remote negative terminal on shock tower (Fig. 6).
- (2) Remove air cleaner resonator, refer to Group 14, Fuel.



## REMOVAL AND INSTALLATION (Continued)



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**Fig. 6 Remove Remote Battery Cable at Shock Tower**

(3) Remove three Transmission Control Module (TCM) mounting screws. Move TCM to provide access to top starter mounting bolt. DO NOT disconnect TCM wiring.

(4) Remove top bolt attaching starter to transmission housing (Fig. 8).

(5) Raise vehicle.

(6) Remove battery positive cable nut from starter and remove cable.

(7) Disconnect push on solenoid connector. Unlock the red locking tab and compress lock to release the connector (2.0L only).

(8) Remove the bottom bolt attaching starter to transmission housing (Fig. 8).

(9) Remove starter from vehicle.

**INSTALLATION**

(1) With vehicle is raised, set starter face into transmission housing.

(2) Lower vehicle.

(3) Install top starter mounting bolt but do not tighten.

(4) Raise vehicle.

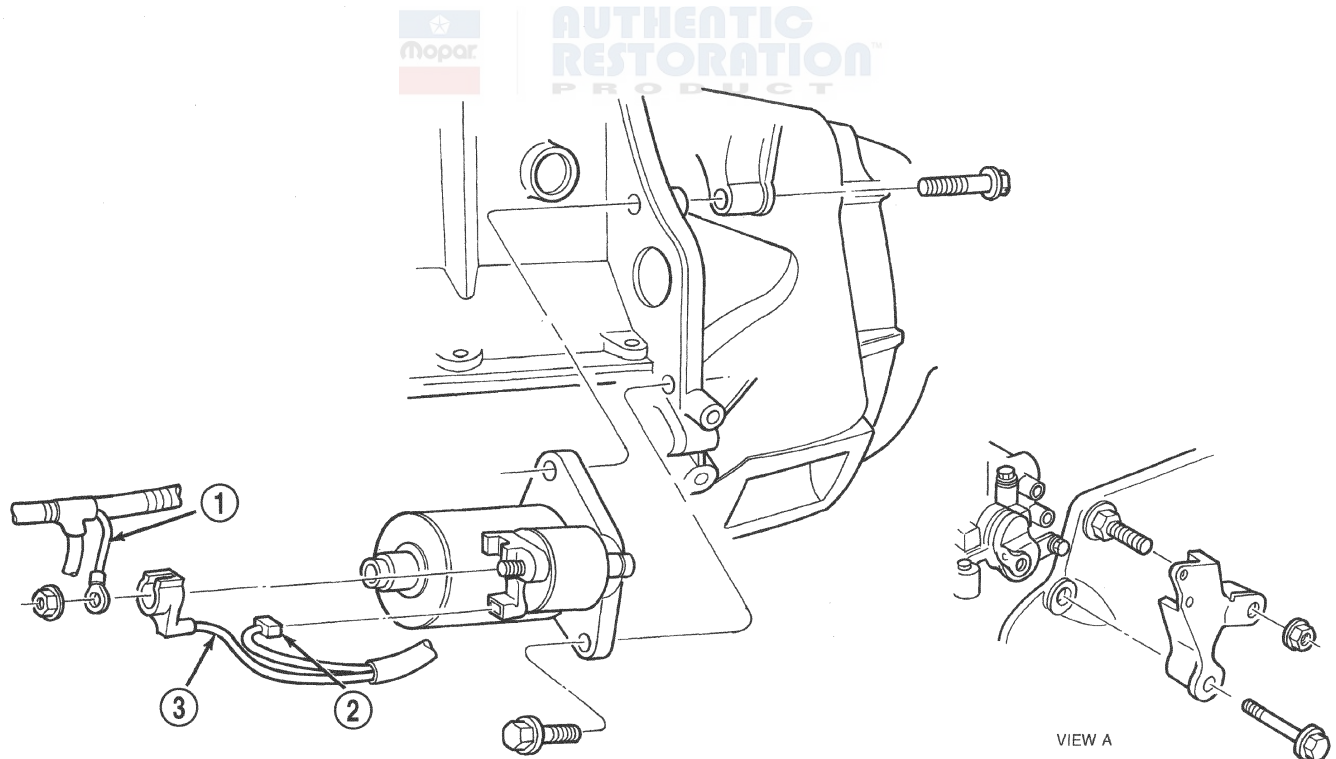
(5) Install bottom starter mounting bolt and tighten to 54 N·m (40 ft. lbs.) torque.

(6) Clean corrosion/dirt from wire terminals before installing wiring to the solenoid.

(7) Connect battery positive cable to solenoid post (Fig. 8).

(8) Connect the push-on solenoid connector.

(9) Lower vehicle.



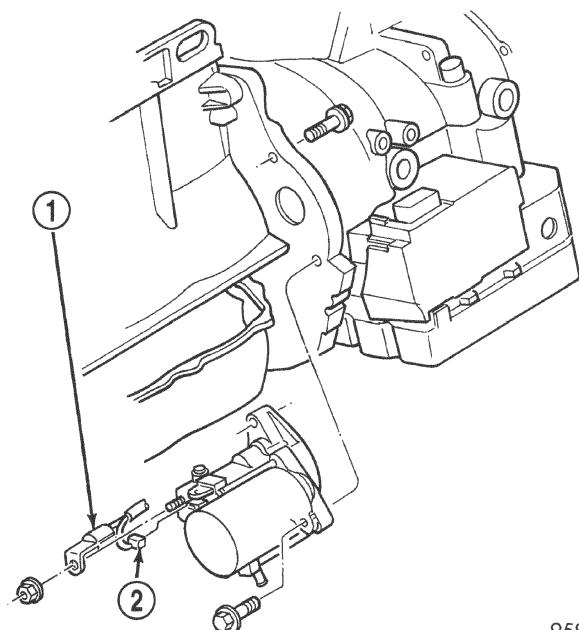
958B-4

**Fig. 7 Wire Terminal Connection – 2.0L Engine**

1 – GENERATOR OUTPUT WIRE

2 – PUSH ON SOLENOID CONNECTOR

3 – BATTERY POSITIVE WIRE

**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 8 Wire Terminal Connection**

- 1 - BATTERY POSITIVE WIRE  
2 - PUSH ON SOLENOID CONNECTOR

(10) Tighten top starter bolt to 54 N·m (40 ft. lbs.) torque.

(11) Install TCM and the mounting screws.

(12) Install air cleaner resonator, refer to Group 14, Fuel.

(13) Connect battery remote cable to the remote terminal.

**2.5L ENGINE****REMOVAL**

(1) Disconnect battery negative cable from remote negative terminal on shock tower (Fig. 6).

(2) Raise vehicle.

(3) Remove oil filter.

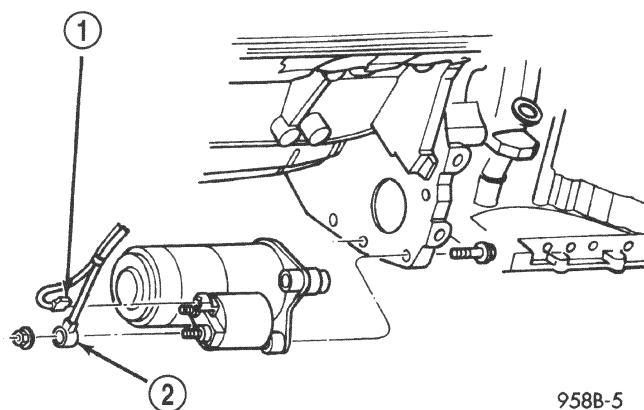
(4) Remove battery positive cable nut from starter and remove cable (Fig. 9).

(5) Disconnect push on solenoid connector.

(6) Remove three bolts attaching starter to transmission housing and remove starter from vehicle.

**INSTALLATION**

For installation, reverse the above procedures. Clean corrosion/dirt from wire terminals before installing wiring to the solenoid.



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**Fig. 9 Wire Terminal Connection - 2.5L Engine**

- 1 - PUSH ON SOLENOID CONNECTOR  
2 - BATTERY POSITIVE WIRE

**STARTER RELAY**

The relay is located in the Power Distribution Center (PDC). Refer to the PDC cover for relay location.

**SPECIFICATIONS****STARTER**

Manufacturer	BOSCH	MELCO	NIPPONDENSO
Engine Application	2.0L	2.5L	2.4L
Power rating	0.95 Kw	1.2 Kw	1.4 Kw
Voltage	12 VOLTS	12 VOLTS	12 VOLTS
Brushes	4	4	4
Drive	Planetary Gear Train	Planetary Gear Train	Offset Gear Reduced

Engine Amperage Draw Test .....150-280 Amps\*

Engine should be up to operating temperature. Extremely heavy oil or tight engine will increase starter amperage draw.

**TORQUE****DESCRIPTION****TORQUE**

Starter Mounting Bolts . . . . . 54 N·m (40 ft. lbs.)

Starter Solenoid Battery Nut . . 10 N·m (90 in. lbs.)

# CHARGING SYSTEM

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BATTERY TEMPERATURE SENSOR.....	2	<b>SPECIFICATIONS</b>	
ELECTRONIC VOLTAGE REGULATOR.....	2	GENERATOR RATINGS.....	4
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## DESCRIPTION AND OPERATION

### CHARGING SYSTEM

#### DESCRIPTION

The charging system consists of:

- Generator
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch (refer to the Ignition System for information)
- Battery (refer to the Battery for information)
- Battery temperature sensor
- Wiring harness and connections (refer to the Wiring for information)

#### OPERATION

The charging system is turned on and off with the ignition switch. When the ignition switch is turned to the ON position, battery voltage is applied to the generator rotor through one of the two field terminals to produce a magnetic field. The generator is driven by the engine through a serpentine belt and pulley arrangement.

The amount of DC current produced by the generator is controlled by the EVR (field control) circuitry, contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

Temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly and to maintain the proper voltage depending on battery temperature.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including the EVR (field control) circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects.

### GENERATOR

#### DESCRIPTION

The generator is belt-driven by the engine. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

#### OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

The Y type stator winding connections deliver the induced AC current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified DC current is delivered to the vehicles electrical system through the generator, battery, and ground terminals.

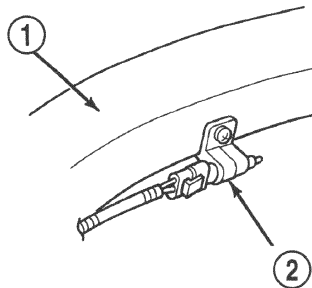
Noise emitting from the generator may be caused by:

- Worn, loose or defective bearings
- Loose or defective drive pulley
- Incorrect, worn, damaged or misadjusted drive belt
- Loose mounting bolts
- Misaligned drive pulley
- Defective stator or diode
- Damaged internal fins



**DESCRIPTION AND OPERATION (Continued)****BATTERY TEMPERATURE SENSOR****DESCRIPTION**

The sensor is located on the rear side of the front bumper beam. (Fig. 1).



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**Fig. 1 Battery Temperature Sensor**

- 1 - BUMPER BEAM  
2 - BATTERY TEMPERATURE SENSOR

**OPERATION**

The battery temperature sensor is used to determine the battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. System voltage will be higher at colder temperatures and is gradually reduced at warmer temperatures.

The battery temperature sensor is also used for OBD II diagnostics. Certain faults and OBD II monitors are either enabled or disabled depending upon the battery temperature sensor input (example: disable purge and EGR, enable LDP). Most OBD II monitors are disabled below 20°F.

**ELECTRONIC VOLTAGE REGULATOR****DESCRIPTION**

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

**OPERATION**

The amount of DC current produced by the generator is controlled by EVR circuitry contained within the PCM. This circuitry is connected in series with the generator's second rotor field terminal and its ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage (B+) and battery temperature (refer to Battery Temperature Sensor for more information). It then determines a target charging voltage. If sensed battery voltage is 0.5 volts or lower than the target voltage, the PCM grounds the field winding until sensed battery voltage is 0.5 volts above target voltage. A circuit in the PCM cycles the ground side of the generator field up to 100 times per second (100Hz), but has the capability to ground the field control wire 100% of the time (full field) to achieve the target voltage. If the charging rate cannot be monitored (limp-in), a duty cycle of 25% is used by the PCM in order to have some generator output. Also refer to Charging System Operation for additional information.

**ON-BOARD DIAGNOSTIC SYSTEM****OPERATION****GENERAL INFORMATION**

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the OBD system. Some circuits are checked continuously and some are checked only under certain conditions.

If the OBD system senses that a monitored circuit is bad, it will put a DTC into electronic memory. The DTC will stay in electronic memory as long as the circuit continues to be bad. The PCM is programmed to clear the memory after 50 engine starts if the problem does not occur again.

**DIAGNOSTIC TROUBLE CODES**

A DTC description can be read using the DRB scan tool. Refer to the appropriate Powertrain Diagnostic Procedures manual for information.

A DTC does not identify which component in a circuit is bad. Thus, a DTC should be treated as a symptom, not as the cause for the problem. In some cases, because of the design of the diagnostic test procedure, a DTC can be the reason for another DTC to be set. Therefore, it is important that the test procedures be followed in sequence, to understand what caused a DTC to be set.

**ERASING DIAGNOSTIC TROUBLE CODES**

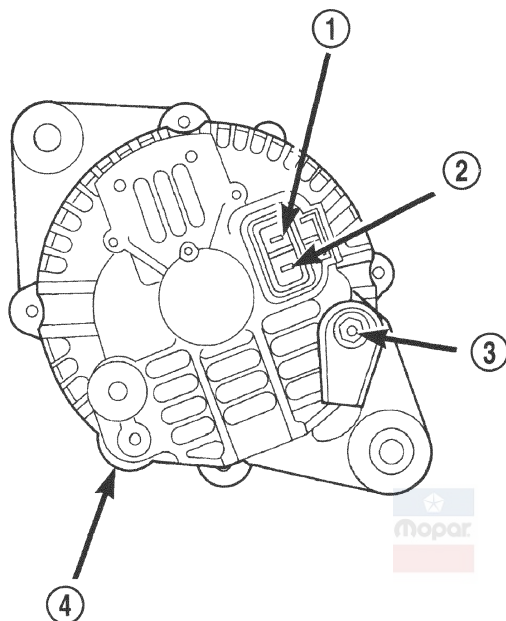
The DRB Scan Tool must be used to erase a DTC.

## REMOVAL AND INSTALLATION

### GENERATOR—2.5L

#### REMOVAL

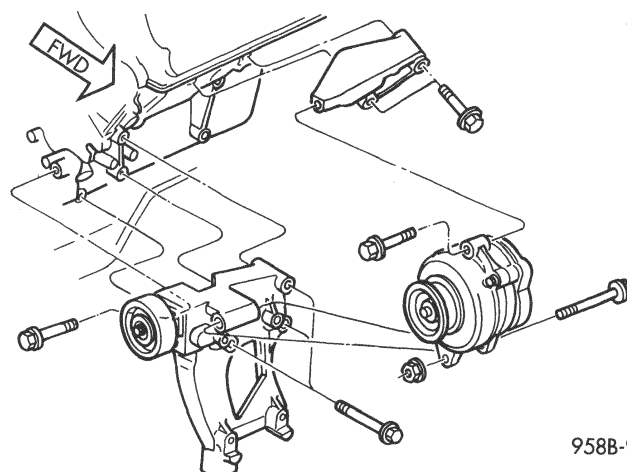
- (1) Disconnect battery negative cable from remote negative terminal on shock tower.
- (2) Unplug field circuit from generator.
- (3) Remove the B+ terminal nut and wire (Fig. 2).



**Fig. 2 Wiring Connections—2.5L**

- 1 - FEED
- 2 - TO POWERTRAIN CONTROL MODULE
- 3 - B+ TERMINAL
- 4 - CASE GROUND

- (4) Loosen top mounting ear bolt.
- (5) Loosen pivot bolt, but do not remove. Be careful not to lose nut (Fig. 3).
- (6) Loosen adjusting bolt on idler to allow removal of the generator drive belt. Refer to the Cooling System.
- (7) Remove pivot bolt, do not drop spacer.
- (8) Remove top mounting ear bolt.
- (9) Remove upper generator bracket.
- (10) Remove generator.



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**Fig. 3 Generator—2.5L Engine**

#### INSTALLATION

- (1) Install generator.
- (2) Install upper generator bracket.
- (3) Install top mounting ear bolt.
- (4) Install pivot bolt, do not drop spacer.
- (5) Install field circuit to generator.
- (6) Install the B+ terminal nut and wire (Fig. 2).
- (7) Tighten adjusting bolt on idler for the generator drive belt. Refer to the Cooling System.
- (8) Tighten the top mounting ear bolt.
- (9) Tighten the pivot bolt (Fig. 3).
- (10) Connect battery negative cable to the remote negative terminal on shock tower.

### BATTERY TEMPERATURE SENSOR

#### REMOVAL

- (1) Remove the negative battery cable.
- (2) Remove the front bumper fascia, refer to the Frame and Bumper section.
- (3) Raise vehicle on host.
- (4) Remove sensor.
- (5) Disconnect electrical connector from sensor.

#### INSTALLATION

- (1) Connect electrical connector to sensor.
- (2) Install sensor.
- (3) Lower vehicle.
- (4) Install the front bumper fascia, refer to the Frame and Bumper section.
- (5) Install the negative battery cable.

SPECIFICATIONS

GENERATOR RATINGS

TYPE	ENGINES	MINIMUM TEST AMPS
DENSO	2.5L	74 amps
The Test Specifications are: 1. 2500 ±20 RPMS 2. Voltage Output 14V ±.5V 3. Field Current 5amps ±.1amp		

TORQUE

DESCRIPTION	TORQUE
Battery Terminal Nut . . . . .	10 N·m (90 in. lbs.)
Battery Hold Down Clamp Bolt . . . . .	10 N·m (90 in. lbs.)
Battery Negative Cable Nut at Shock Tower . . . . .	10 N·m (90 in. lbs.)
Generator B+ Terminal . . . . .	9 N·m (75 in. lbs.)
Generator Mounting Bolt . . . . .	54 N·m (40 ft. lbs.)
Generator Pivot Bolt . . . . .	54 N·m (40 ft. lbs.)





# IGNITION SYSTEM

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## DESCRIPTION AND OPERATION

### IGNITION SYSTEM

#### DESCRIPTION

**NOTE:** The 2.5L engines use a fixed ignition timing system. Basic ignition timing is not adjustable. All spark advance is determined by the Powertrain Control Module (PCM).

The 2.5L engine uses a distributor, crankshaft sensor and ignition coil. **Basic ignition timing is not adjustable.** The system's main components are the distributor, distributor pickup, camshaft signal, crankshaft signal and ignition coil.

#### OPERATION

The crankshaft position sensor and camshaft position sensor are hall effect devices. The camshaft position sensor and crankshaft position sensor generate pulses that are inputs to the PCM. The PCM determines crankshaft position from these sensors. The PCM calculates injector sequence and ignition timing from crankshaft position. For a description of both sensors, refer to Camshaft Position Sensor and Crankshaft Position Sensor in this section.

## SPARK PLUGS PLATINUM

### DESCRIPTION

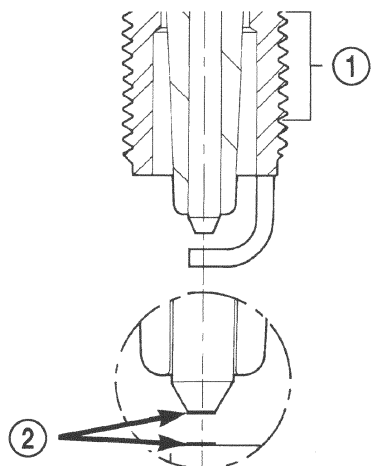
The engine utilize platinum spark plugs. Refer to the maintenance schedule.

All engines use resistor spark plugs. They have resistance values ranging from 6,000 to 20,000 ohms when checked with at least a 1000 volt spark plug tester.

**Do not use an ohm meter to check the resistance of the spark plugs. This will give an inaccurate reading.**

The spark plugs are double platinum and have a recommended service life of 100,000 miles for normal driving conditions per schedule A in this manual. The spark plugs have a recommended service life of 75,000 miles for severe driving conditions per schedule B in this manual. A thin platinum pad is welded to both electrode ends as show in (Fig. 1). Extreme care must be used to prevent spark plug cross threading, mis-gaping and ceramic insulator damage during plug removal and installation.

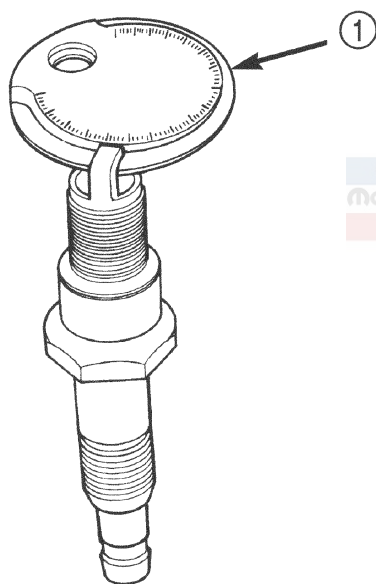
**CAUTION:** Cleaning of the platinum plug may damage the platinum tip.

**DESCRIPTION AND OPERATION (Continued)**

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**Fig. 1 Platinum Pads**

- 1 - APPLY ANTI-SEIZE COMPOUND HERE ONLY  
2 - PLATINUM SPARK SURFACE



803f5851

**Fig. 2 Setting Spark Plug Electrode Gap**

- 1 - TAPER GAUGE

**SPARK PLUG CABLES****DESCRIPTION**

Spark Plug cables are sometimes referred to as secondary ignition wires. They transfer electrical current from the distributor or coil pack, to individual spark plugs at each cylinder. The resistor type, non-metallic spark plug cables provide suppression of radio frequency emissions from the ignition system.

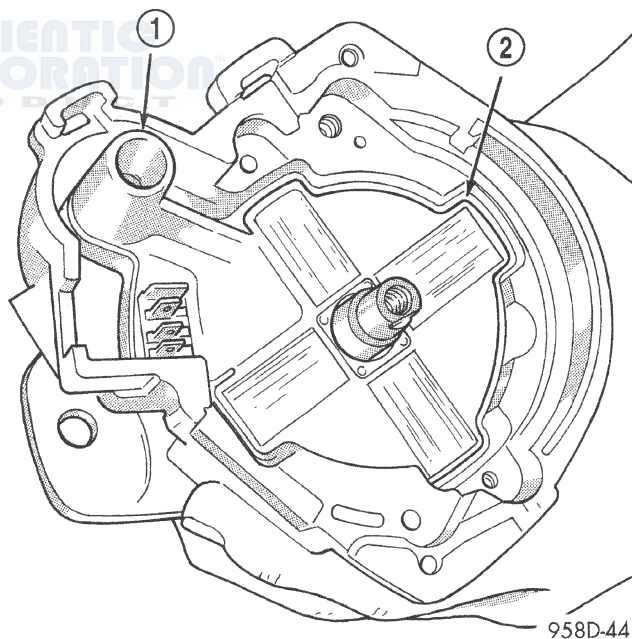
Check the spark plug cable connections for good contact at the coil or coil pack and distributor cap towers and at the spark plugs. Terminals should be

fully seated. The nipples and spark plug covers should be in good condition. Nipples should fit tightly on the coil or coil pack and distributor cap towers and spark plug cover should fit tight around spark plug insulators. Loose cable connections can cause ignition malfunctions by permitting water to enter the towers, corroding, and increasing resistance. **To maintain proper sealing at the terminal connections, the connections should not be broken unless testing indicates high resistance, an open circuit or other damage.**

Clean high tension cables with a cloth moistened with a non-flammable solvent and wipe dry. Check for brittle or cracked insulation. Plastic clips in various locations protect the cables from damage. When the cables are replaced the clips must be used to prevent damage to the cables.

**IGNITION COIL—2.5L****DESCRIPTION**

The ignition coil is located inside the distributor. The distributor is mounted to the right end of the engine block behind the thermostat housing (Fig. 3).



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**Fig. 3 Ignition Coil—2.5L Engine**

- 1 - HIGH TENSION TOWER  
2 - IGNITION COIL

**OPERATION**

The 2.5L engine uses an epoxy type coil. The coils are not oil filled. The windings are embedded in a heat and vibration resistant epoxy compound.

On a 2.5L The PCM controls ignition timing by turning on and off the transistor in the distributor.



## DESCRIPTION AND OPERATION (Continued)

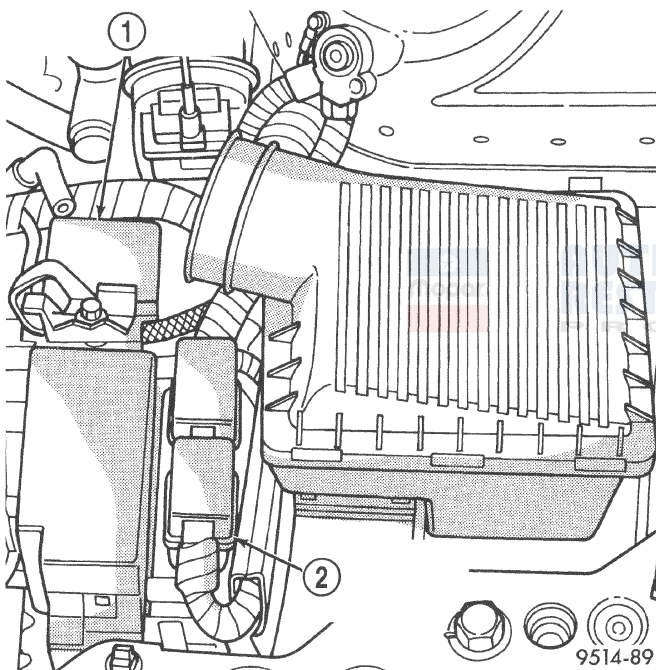
By switching the ground path for the coil on and off, the PCM adjusts ignition timing to meet changing engine operating conditions.

The PCM operates the ignition coil through the Auto Shutdown (ASD) relay. When the relay is energized by the PCM, battery voltage is connected to the ignition coil positive terminal. The PCM will de-energize the ASD relay if it does not receive an input from the distributor pick-up. Refer to Auto Shutdown (ASD) Relay and Fuel Pump Relay in this section.

## AUTOMATIC SHUTDOWN RELAY

### DESCRIPTION

The ASD relay is located in the PDC (Fig. 4). The inside top of the PDC cover has a label showing relay and fuse identification.



**Fig. 4 Power Distribution Center (PDC)**

- 1 - POWER DISTRIBUTION CENTER
- 2 - POWERTRAIN CONTROL MODULE

### OPERATION

The Automatic Shutdown (ASD) relay supplies battery voltage to the fuel injectors, generator field, electronic ignition coil and the heating elements in the oxygen sensors.

Refer to the Wiring Diagrams for circuit information.

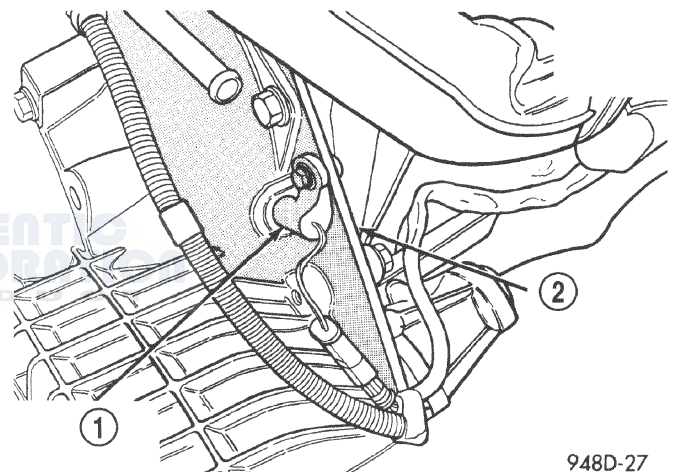
The PCM controls the ASD relay by switching the ground path for the solenoid side of the relay on and off. The PCM turns the ground path off when the ignition switch is in the Off position unless the O2 Heater Monitor test is being run. Refer to the

On-Board Diagnostics in the Emission Control section. When the ignition switch is in On or Start, the PCM momentarily turns on the ASD relay. While the relay is on the PCM monitors the crankshaft and camshaft position sensor signals to determine engine speed and ignition timing (coil dwell). If the PCM does not receive crankshaft and camshaft position sensor signals when the ignition switch is in the Run position, it will de-energize the ASD relay.

## CRANKSHAFT POSITION SENSOR—2.5L

### DESCRIPTION

The crankshaft sensor is located on the rear of the transmission housing, above the differential housing (Fig. 5). The sensor connector has a christmas tree attached to the heater tube bracket. The bottom of the sensor is positioned next to the drive plate.



**Fig. 5 Crankshaft Position Sensor Location—Typical**

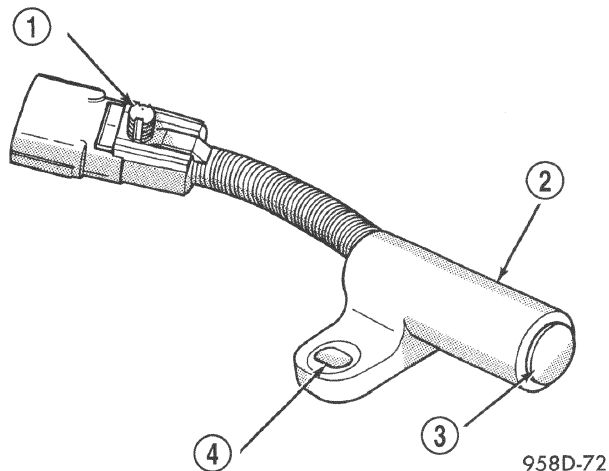
- 1 - CRANKSHAFT POSITION SENSOR
- 2 - TRANSAXLE HOUSING

### OPERATION

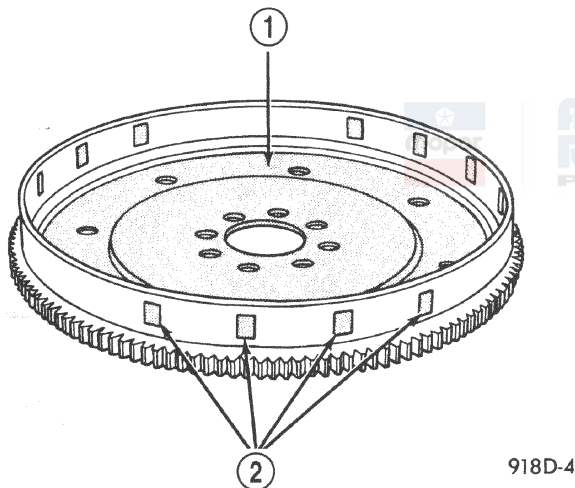
The crankshaft position sensor (Fig. 6) detects slots cut into the transmission driveplate extension. There are 3 sets of slots. Each set contains 4 slots, for a total of 12 slots (Fig. 7). Basic timing is set by the position of the last slot in each group. Once the Powertrain Control Module (PCM) senses the last slot, it determines crankshaft position (which piston will next be at TDC) from the camshaft position sensor input. The 4 pulses generated by the crankshaft position sensor represent the 69°, 49°, 29°, and 9° BTDC marks. It may take the PCM one engine revolution to determine crankshaft position.

The PCM uses crankshaft position reference to determine injector sequence, ignition timing and the presence of misfire. Once the PCM determines crankshaft position, it begins energizing the injectors in sequence.



**DESCRIPTION AND OPERATION (Continued)****Fig. 6 Crankshaft Position Sensor—Adjustable**

- 1 - PUSH ON CLIP
- 2 - CRANKSHAFT POSITION SENSOR
- 3 - PAPER SPACER
- 4 - ADJUSTMENT HOLE

**Fig. 7 Timing Slots**

- 1 - TORQUE CONVERTER DRIVE PLATE
- 2 - SLOTS

**CAMSHAFT POSITION SENSOR—2.5L****DESCRIPTION**

The 2.5L engine is equipped with a camshaft driven mechanical distributor, containing a shaft driven distributor rotor. The distributor is also equipped with an internal camshaft position (fuel sync) sensor (Fig. 8). This sensor provides fuel injection synchronization and cylinder identification to the PCM.

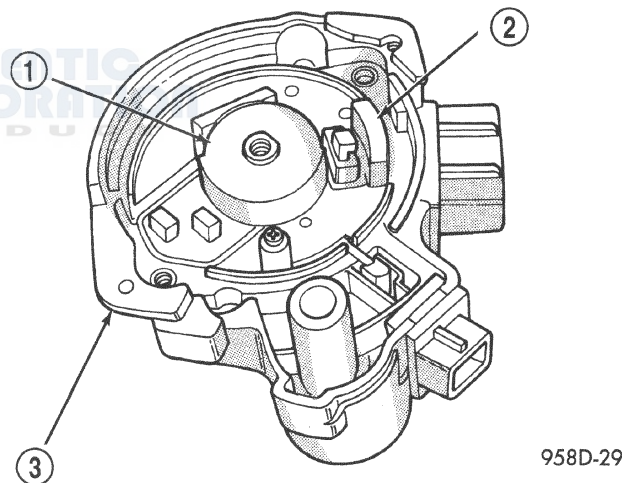
**OPERATION**

The PCM determines fuel injection synchronization and cylinder identification from inputs provided by the camshaft position sensor and crankshaft position sensor. From the two inputs, the PCM determines crankshaft position.

The camshaft position sensor contains a hall effect device called a sync signal generator. This sync signal generator detects a rotating pulse ring (shutter) on the distributor shaft. The pulse ring rotates 180 through the sync signal generator. Its signal is used in conjunction with the crankshaft position sensor to differentiate between fuel injection and spark events. It is also used to synchronize the fuel injectors with their respective cylinders.

When the leading edge of the shutter enters the sync signal generator, the interruption of magnetic field causes the voltage to switch high. This causes a sync signal of approximately 5 volts.

When the trailing edge of the shutter leaves the sync signal generator, the change of magnetic field causes the sync signal voltage to switch low to 0 volts.

**Fig. 8 Camshaft Position Sensor—2.5L Engine**

- 1 - PULSE RING
- 2 - SYNC SIGNAL GENERATOR
- 3 - DISTRIBUTOR

Since the shutter rotates at half crankshaft speed, it may take 1 engine revolution during cranking for the PCM to determine the position of piston number 6.

**KNOCK SENSOR****DESCRIPTION**

The knock sensor threads into the cylinder block.

## DESCRIPTION AND OPERATION (Continued)

### OPERATION

When the knock sensor detects a knock in one of the cylinders, it sends an input signal to the PCM. In response, the PCM retards ignition timing for all cylinders by a scheduled amount.

Knock sensors contain a piezoelectric material which constantly vibrates and sends an input voltage (signal) to the PCM while the engine operates. As the intensity of the crystal's vibration increases, the knock sensor output voltage also increases.

**NOTE:** Over or under tightening affects knock sensor performance, possibly causing improper spark control.

### LOCK KEY CYLINDER

#### DESCRIPTION

The lock cylinder is inserted in the end of the housing opposite the ignition switch.

#### OPERATION

The ignition key rotates the cylinder to 5 different detents (Fig. 9) :

- Accessory
- Off (lock)
- Unlock
- On/Run
- Start

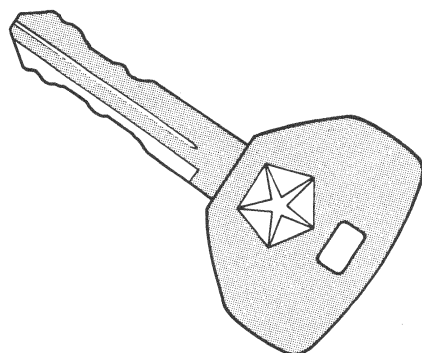
● UNLOCK

● ON/RUN

● START

● OFF

● ACCESSORY



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*Fig. 9 Ignition Lock Cylinder Detents*

### IGNITION INTERLOCK

#### OPERATION

All vehicles equipped with automatic transaxles have an interlock system. The system prevents shifting the vehicle out of Park unless the ignition lock cylinder is in the Off, Run or Start position. In addition, the operator cannot rotate the key to the lock

position unless the shifter is in the park position. On vehicles equipped with floor shift refer to the - Transaxle for Automatic Transmission Shifter/Ignition Interlock.

## REMOVAL AND INSTALLATION

### SPARK PLUGS AND CABLES—2.5L

When replacing the spark plug and coil cables, route the cables correctly and secure them in the appropriate retainers. Failure to route the cables properly can cause the radio to reproduce ignition noise, cross ignition of the spark plugs or short circuit the cables to ground.

**CAUTION:** Never attempt to file the electrodes or use a wire brush for cleaning platinum plugs. This would damage the platinum pads which would shorten spark plug life.

Never force a gap gauge between the platinum electrodes or adjust the gap on platinum spark plugs without reading the 2.5L Spark Plug Gap Measurement procedures below.

Always tighten spark plugs to the specified torque. Over tightening can cause distortion resulting in a change in the spark plug gap. Overtightening can also damage the cylinder head. Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

Due to the engine packaging environment for the 2.5L engines, extreme care should be used when installing the spark plugs to avoid cross threading problems.

### 2.5L SPARK PLUG GAP MEASUREMENT

**CAUTION:** The Platinum pads can be damaged during the measurement of checking the gap if extreme care is not used.

- Use only a taper gap gauge (Fig. 2)
- Never force the gap gauge through the platinum pads. Only apply enough force until resistance is felt.
- Never use a wire brush or spark plug cleaner machine to clean platinum spark plugs
- Use an OSHA approved air nozzle when drying gas fouled spark plugs.

If gap adjustment is required of platinum plug, bend only the ground electrode. DO NOT TOUCH the platinum pads. Use only a proper gapping tool and check with a taper gap gauge (Fig. 1).

Apply a very small amount of anti-seize compound to the threads when reinstalling the vehicle's original spark plugs that have been determined good. **Do not apply anti-seize compound to new spark plugs.**

**REMOVAL AND INSTALLATION (Continued)**

**NOTE:** Anti-seize compound is electrically conductive and can cause engine misfires if not applied correctly. It is extremely important that the anti-seize compound doesn't make contact with the spark plug electrodes or ceramic insulator.

**SPARK PLUG REMOVAL—#2, #4 or #6**

Always remove the ignition cable by grasping at the spark plug boot turning, the boot 1/2 turn and pulling straight back in a steady motion.

(1) Prior to removing the spark plug spray compressed air around the spark plug hole and the area around the spark plug.

(2) Remove the spark plug using a quality socket with a rubber or foam insert.

(3) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

**INSTALLATION**

(1) To avoid cross threading, start the spark plug into the cylinder head by hand.

(2) Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

(3) Install ignition cables over spark plugs.

**SPARK PLUG REMOVAL—#1, #3 or #5**

(1) Disconnect negative cable from auxiliary jumper terminal.

(2) Remove the intake manifold, refer to the Engine Section for the procedure.

(3) Always remove the ignition cable by grasping at the spark plug boot turning, the boot 1/2 turn and pulling straight back in a steady motion.

(4) Prior to removing the spark plug spray compressed air around the spark plug hole and the area around the spark plug.

(5) Remove the spark plug using a quality socket with a rubber or foam insert.

(6) Inspect the spark plug condition. Refer to Spark Plug Condition in this section.

**SPARK PLUG INSTALLATION**

(1) To avoid cross threading, start the spark plug into the cylinder head by hand.

(2) Tighten spark plugs to 28 N·m (20 ft. lbs.) torque.

(3) Install ignition cables over spark plugs.

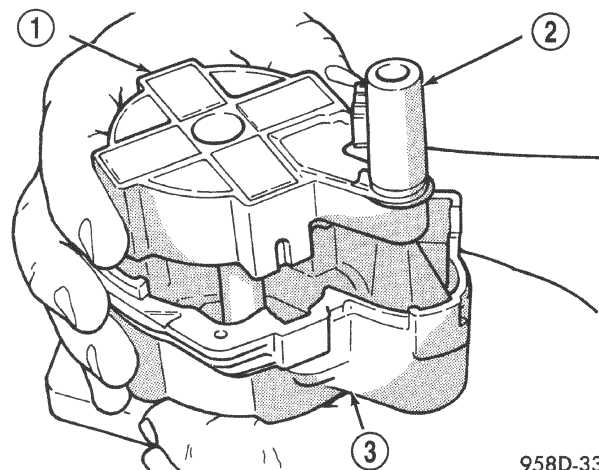
(4) Install the intake manifold, refer to the Engine section

(5) Tighten air inlet tube clamps to 3 N·m  $\pm$  1 (25  $\pm$  5 in. lbs.) torque.

(6) Connect negative terminal to auxiliary jumper terminal.

**IGNITION COIL—2.5L**

The ignition coil is located in the distributor housing (Fig. 10).



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**Fig. 10 Ignition Coil**

- 1 - IGNITION COIL
- 2 - COIL TOWER
- 3 - DISTRIBUTOR HOUSING

If ignition coil is defective, replace distributor assembly. Refer to Distributor Service.

**AUTOMATIC SHUTDOWN RELAY**

The relay is located in the Power Distribution Center (PDC) (Fig. 11). The PDC is located in the engine compartment. For the location of the relay within the PDC, refer to the PDC cover for location. Check electrical terminals for corrosion and repair as necessary.

**CRANKSHAFT POSITION SENSOR—2.5L****REMOVAL**

(1) Remove speed control servo from driver's side strut tower.

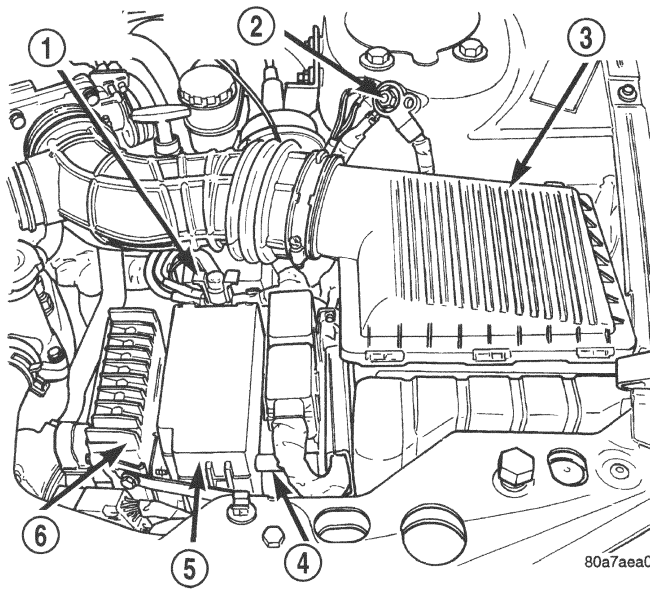
(2) Remove crankshaft position sensor retaining bolt (Fig. 12).

(3) Pull crankshaft position sensor straight up out of the transaxle housing.

(4) (Disconnect crankshaft position sensor electrical connector from the wiring harness connector.

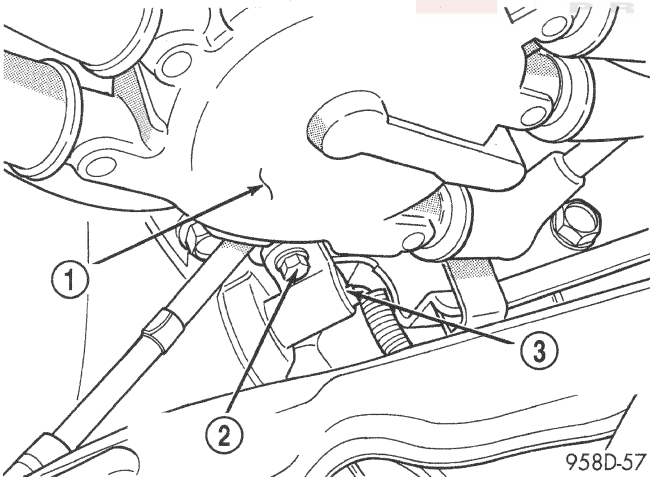


## REMOVAL AND INSTALLATION (Continued)



**Fig. 11 Power Distribution Center (PDC)**

- 1 - BATTERY POSITIVE
- 2 - BATTERY GROUND
- 3 - AIR CLEANER
- 4 - PCM
- 5 - PDC
- 6 - TCM



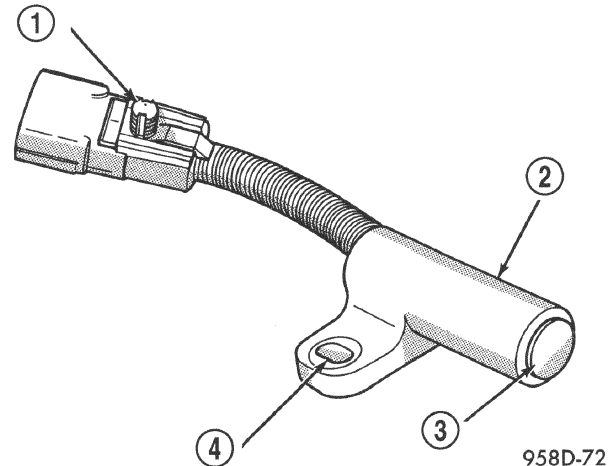
**Fig. 12 Crankshaft Position Sensor**

- 1 - DISTRIBUTOR
- 2 - HOLD DOWN BOLT
- 3 - CRANKSHAFT POSITION SENSOR

### INSTALLATION—ADJUSTABLE

All vehicles will be equipped with an adjustable crankshaft position sensor. This can be identified by an elongated mounting hole in the sensor.

**NOTE:** If the removed sensor is to be reinstalled, clean off the old spacer on the sensor face. A **NEW SPACER** must be attached to the sensor face before installation. If the sensor is being replaced, confirm that the paper spacer is attached to the face of the new sensor (Fig. 13).



**Fig. 13 Crankshaft Position Sensor and Spacer**

- 1 - PUSH ON CLIP
- 2 - CRANKSHAFT POSITION SENSOR
- 3 - PAPER SPACER
- 4 - ADJUSTMENT HOLE

(1) Install sensor in transaxle and push sensor down until contact is made with the drive plate. While holding the sensor in this position, install and tighten the retaining bolt to 12 N·m (105 in. lbs.) torque.

(2) Connect crankshaft position sensor electrical connector to the wiring harness connector.

(3) Attach connector to heater tube bracket.

(4) Install speed control servo. Tighten nuts to 9 N·m (80 in. lbs.) torque.

### DISTRIBUTOR—2.5L

#### REMOVAL

(1) Remove bolt holding air inlet resonator to intake manifold.

(2) Loosen clamps holding air cleaner cover to air cleaner housing.

(3) Remove PCV make-up air hose from air inlet tube.

(4) Loosen hose clamp at throttle body.

(5) Remove air inlet tube, resonator and air cleaner cover.

(6) Remove EGR tube.

(7) Remove spark plug cables from distributor cap.

(8) Loosen distributor cap hold-down screws and remove cap (Fig. 14).

## REMOVAL AND INSTALLATION (Continued)

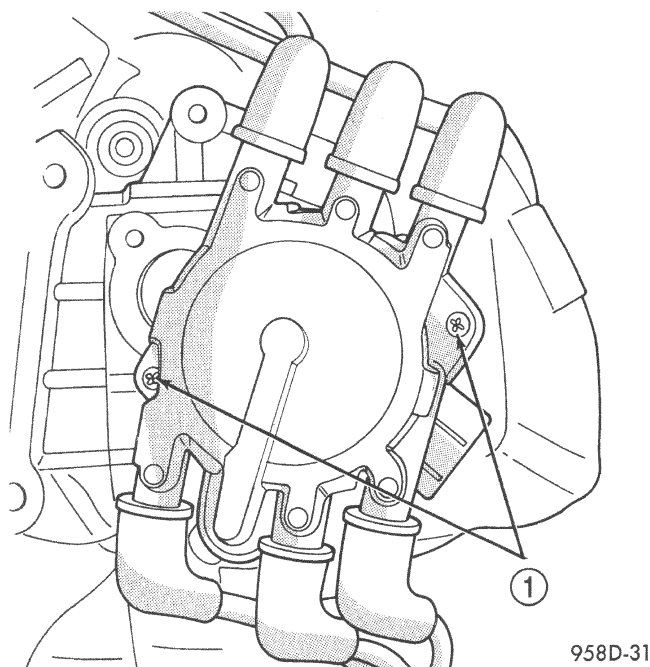


Fig. 14 Distributor Cap Screws

1 - DISTRIBUTOR CAP SCREWS

(9) Mark the rotor position and remove rotor. The mark indicates where to position the rotor when reinstalling the distributor.

(10) Remove 2 harness connectors from distributor (Fig. 15).

(11) Remove 2 sets of distributor holddown nuts and washers from studs.

(12) Remove bolt and spark plug cable mounting bracket from top of distributor housing.

(13) Remove bolt and transmission dipstick tube.

(14) Carefully remove distributor from engine.

## INSTALLATION

(1) Install rotor on shaft.

(2) Position distributor in engine. Make certain that O-ring is properly seated on distributor. If O-ring is cracked or nicked replace with a new one.

(3) Carefully engage distributor drive with slotted end of camshaft. When the distributor is installed properly, the rotor will be in line with previously scribe line on air intake plenum. **If engine was cranked while distributor was removed, establish proper relationship between the distributor shaft and Number 1 piston position as follows:**

(a) Rotate the crankshaft until number one piston is at top of compression stroke.

(b) Rotate rotor to number one rotor terminal.

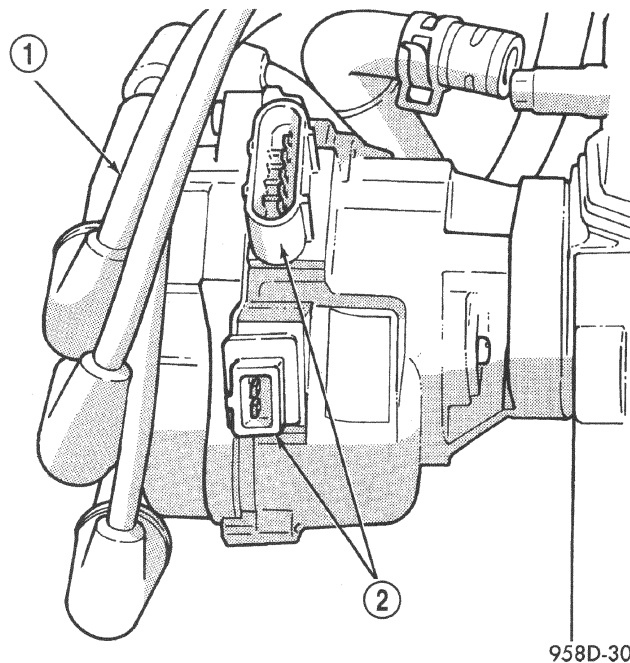


Fig. 15 Distributor Electrical Connectors—Viewed From Rear of Distributor

1 - SPARK PLUG CABLES

2 - DISTRIBUTOR CONNECTORS

(c) Lower distributor into opening, engaging distributor drive with drive on camshaft. With distributor fully seated on engine, rotor should be under the number 1 terminal.

(4) Install distributor holddown washers and nuts. Tighten nuts to 13 N·m (9 ft. lbs.).

(5) Install spark plug cable bracket.

(6) Install 2 harness connectors to distributor.

(7) Install distributor cap.

(8) Install spark plug cables onto distributor cap. The cap is numbered as well as the cables. Ensure sure all high tension wires are firmly in the cap towers.

(9) Install transmission dipstick tube.

(10) Install EGR tube to intake manifold. Tighten bolts to 11 N·m (95 in. lbs.) torque.

(11) Install air inlet tube, resonator and air cleaner cover.

(12) Tighten hose clamp at throttle body.

(13) Install PCV make-up air hose from air inlet tube.

(14) Tighten clamps holding air cleaner cover to air cleaner housing.

(15) Install bolt holding air inlet resonator to intake manifold.

**REMOVAL AND INSTALLATION (Continued)****DISTRIBUTOR CAP—2.5L****REMOVAL**

- (1) Remove bolt holding air inlet resonator to intake manifold.
- (2) Loosen clamps holding air cleaner cover to air cleaner housing.
- (3) Remove PCV make-up air hose from air inlet tube.
- (4) Loosen hose clamp at throttle body.
- (5) Remove air inlet tube, resonator and air cleaner cover.
- (6) Remove EGR tube.
- (7) Remove spark plug cables from distributor cap.
- (8) Loosen distributor cap holddown screws and remove cap (Fig. 14).
- (9) Transfer cables from old cap to new cap. The cap is numbered and so are the cables.

**INSTALLATION**

- (1) Install distributor cap.
- (2) Install EGR tube.
- (3) Install air inlet tube, resonator and air cleaner cover.
- (4) Tighten hose clamp at throttle body.
- (5) Install PCV make-up air hose from air inlet tube.
- (6) Tighten clamps holding air cleaner cover to air cleaner housing.
- (7) Install bolt holding air inlet resonator to intake manifold.

**DISTRIBUTOR ROTOR—2.5L****REMOVAL**

- (1) Remove bolt holding air inlet resonator to intake manifold.
- (2) Loosen clamps holding air cleaner cover to air cleaner housing.
- (3) Remove PCV make-up air hose from air inlet tube.
- (4) Loosen hose clamp at throttle body.
- (5) Remove air inlet tube, resonator and air cleaner cover.
- (6) Remove EGR tube.
- (7) Remove spark plug cables from distributor cap.
- (8) Loosen distributor cap holddown screws and remove cap (Fig. 14).

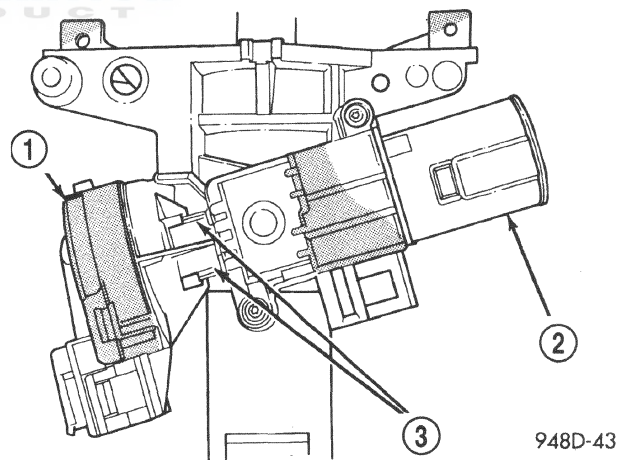
- (9) Mark the rotor position and remove rotor. The mark indicates where to position the rotor when reinstalling the distributor.

**INSTALLATION**

- (1) Install rotor on shaft.
- (2) Install distributor cap.
- (3) Install spark plug cables onto distributor cap. The cap is numbered as well as the cables. Ensure sure all high tension wires are firmly in the cap towers.
- (4) Install EGR tube to intake manifold. Tighten bolts to 11 N·m (95 in. lbs.) torque.
- (5) Install air inlet tube, resonator and air cleaner cover.
- (6) Tighten hose clamp at throttle body.
- (7) Install PCV make-up air hose to air inlet tube.
- (8) Tighten clamps holding air cleaner cover to air cleaner housing.
- (9) Tighten bolt holding air inlet resonator to intake manifold.

**IGNITION SWITCH**

The ignition switch attaches to the lock cylinder housing on the end opposite the lock cylinder (Fig. 16). For ignition switch terminal and circuit identification, refer to Group 8W, Wiring Diagrams.



**Fig. 16 Ignition Switch—Viewed From Below Column**

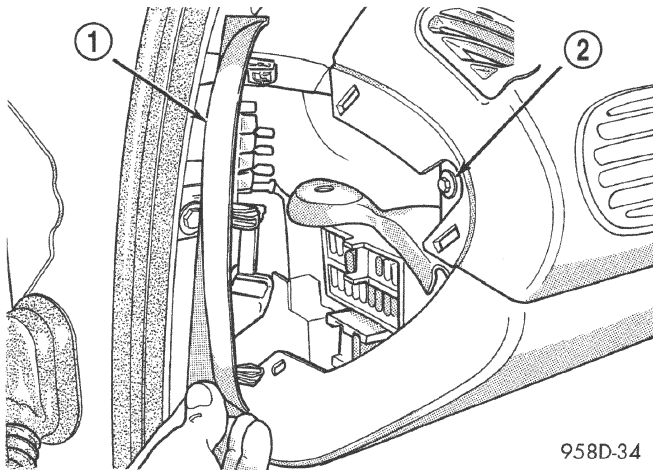
- 1 - IGNITION SWITCH  
2 - LOCK CYLINDER HOUSING  
3 - RETAINING TABS



**REMOVAL AND INSTALLATION (Continued)****REMOVAL**

(1) Disconnect negative cable from auxillary jumper terminal on driver's side strut tower.

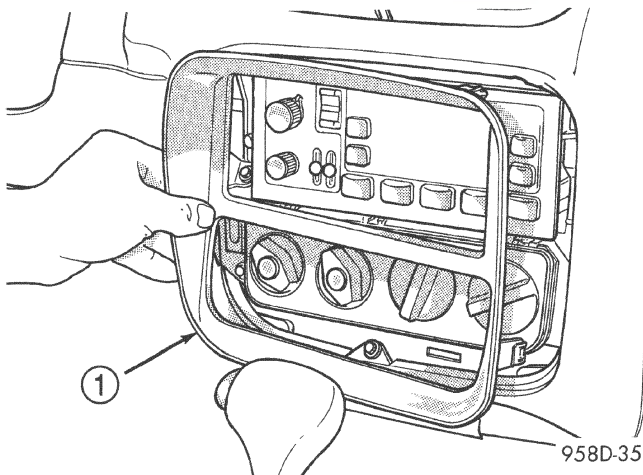
(2) Remove fuse panel cover from left end of instrument panel. Remove screw holding end of instrument panel top cover (Fig. 17).



**Fig. 17 Instrument Panel Top Cover—Left End**

- 1 - FUSE PANEL COVER  
2 - TOP COVER SCREW

(3) Pull center bezel off (Fig. 18).



**Fig. 18 Center Bezel**

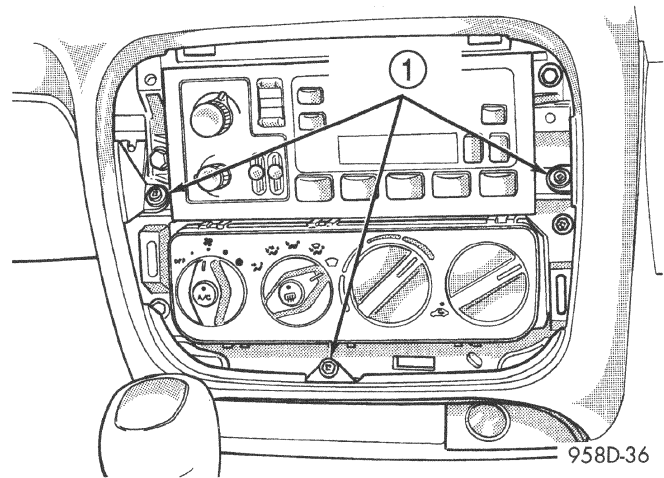
- 1 - CENTER BEZEL

(4) Remove screws holding instrument panel top cover to center of instrument panel (Fig. 19).

(5) Pull instrument panel top cover up enough to gain access to knee bolster screws (Fig. 20).

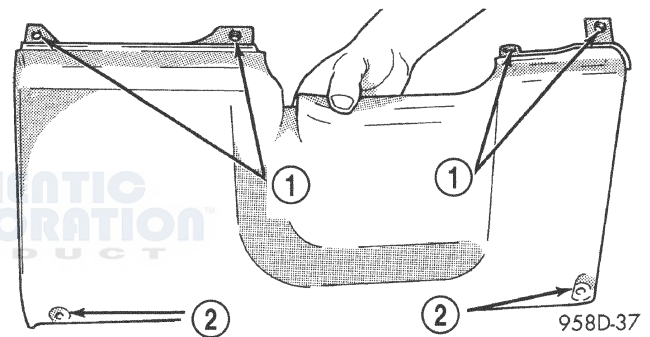
(6) Remove lower knee bolster screws and knee bolster.

(7) Remove screws from lower steering column shroud (Fig. 21).



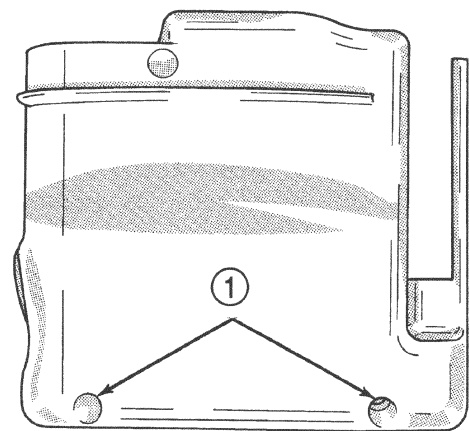
**Fig. 19 Instrument Panel Top Cover—Center**

- 1 - TOP COVER SCREWS



**Fig. 20 Knee Bolster Attaching Points**

- 1 - KNEE BOLSTER SCREW LOCATIONS UNDER TOP COVER  
2 - LOWER SCREW LOCATIONS

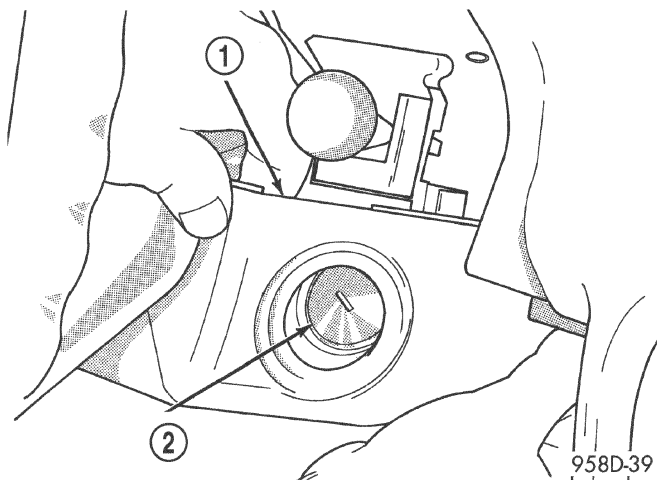


**Fig. 21 Lower Steering Column Shroud Screw Locations**

- 1 - LOWER STEERING COLUMN SHROUD SCREW LOCATIONS

**REMOVAL AND INSTALLATION (Continued)**

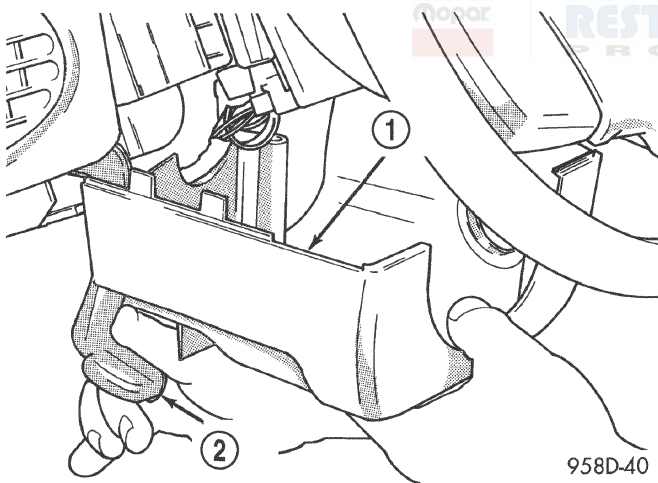
(8) Pull lower shroud to clear ignition cylinder and key release, if equipped (Fig. 22).



**Fig. 22 Remove Lower Shroud From Ignition Cylinder**

- 1 - LOWER SHROUD  
2 - KEY CYLINDER

(9) Hold tilt wheel lever down and slide lower shroud forward to remove it from column (Fig. 23).



**Fig. 23 Lower Shroud Removal**

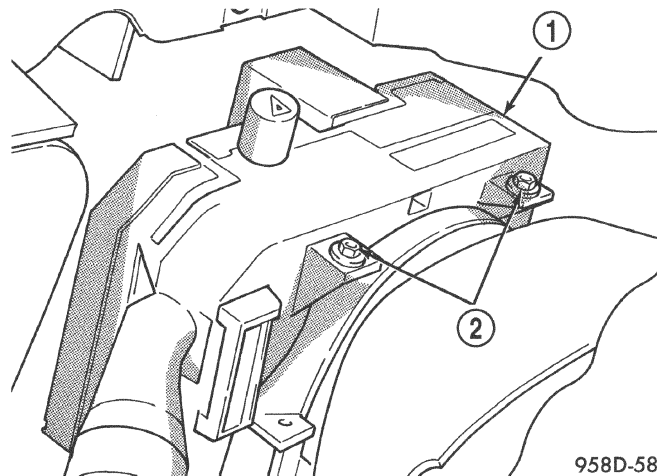
- 1 - LOWER SHROUD  
2 - TILT LEVER

(10) Tilt wheel to full down position and remove upper steering column shroud.

(11) Remove screws holding multi-function switch to lock housing (Fig. 24).

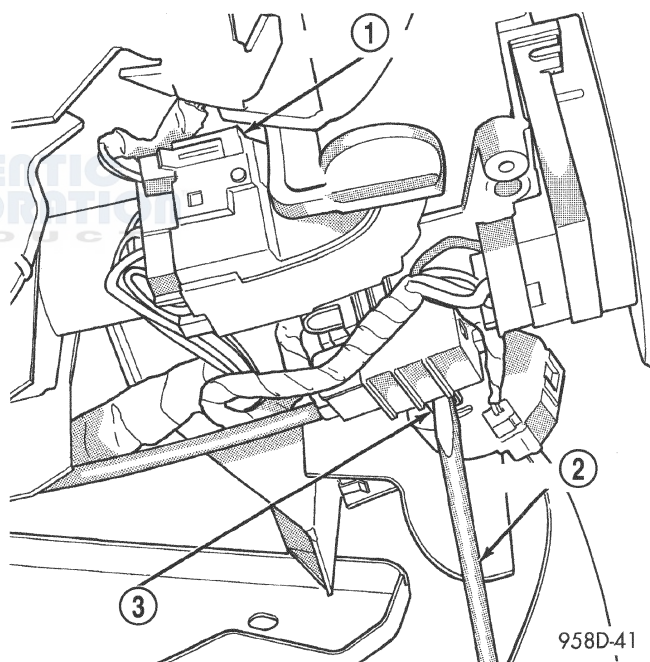
(12) Place key cylinder in RUN position. Depress lock cylinder retaining tab and remove key cylinder (Fig. 25).

(13) Disconnect electrical connectors from ignition switch (Fig. 26) and (Fig. 27).



**Fig. 24 Multi-Function Switch Removal/Installation**

- 1 - MULTI-FUNCTION SWITCH  
2 - ATTACHING SCREWS



**Fig. 25 Lock Cylinder Removal**

- 1 - IGNITION SWITCH  
2 - SCREWDRIVER  
3 - LOCK CYLINDER RETAINING TAB

(14) Remove ignition switch mounting screw (Fig. 26) with a #10 Torx® tamper proof bit.

(15) Depress retaining tabs (Fig. 16) and pull ignition switch from steering column.

**INSTALLATION**

(1) Ensure the ignition switch is in the RUN position and the actuator shaft in the lock housing is in the RUN position.

## REMOVAL AND INSTALLATION (Continued)

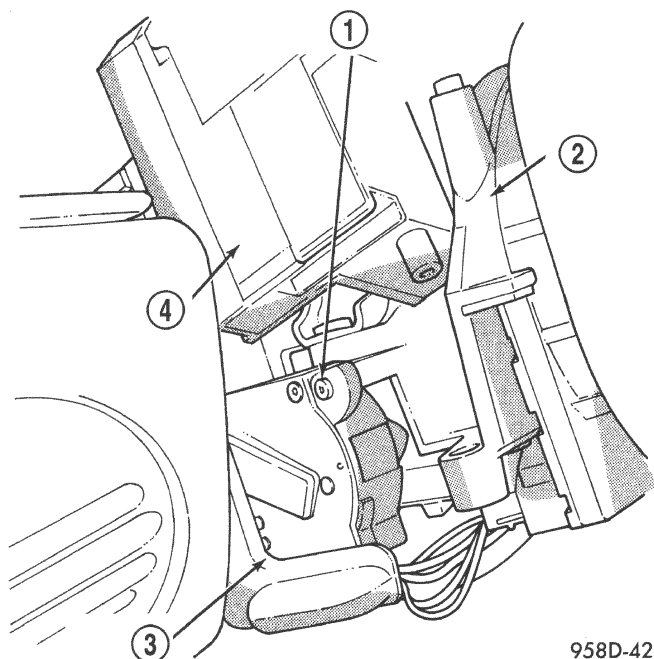


Fig. 26 Ignition Switch

- 1 - ATTACHING/GROUNDING SCREW
- 2 - LOCK HOUSING
- 3 - IGNITION SWITCH
- 4 - MULTI-FUNCTION SWITCH

958D-42

(2) Carefully install the ignition switch. The switch will snap over the retaining tabs (Fig. 28). Install mounting screw (Fig. 26).

(3) Install electrical connectors to ignition switch.

(4) Install upper and lower shrouds.

(5) Install key cylinder (cylinder retaining tab will depress only in the RUN position).

(6) Connect negative cable to battery.

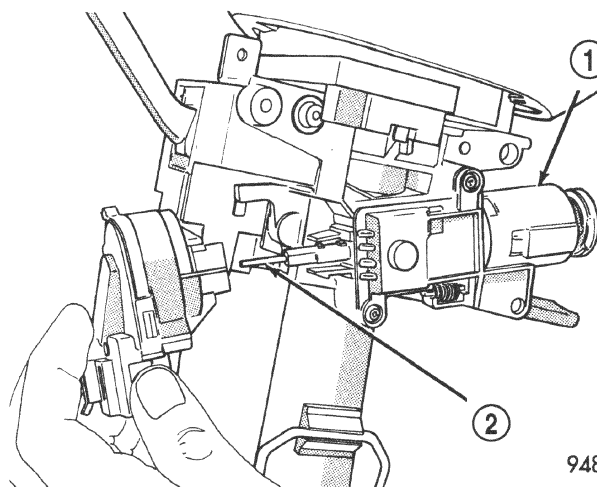


Fig. 28 Ignition Switch Installation

- 1 - LOCK CYLINDER HOUSING
- 2 - SHAFT

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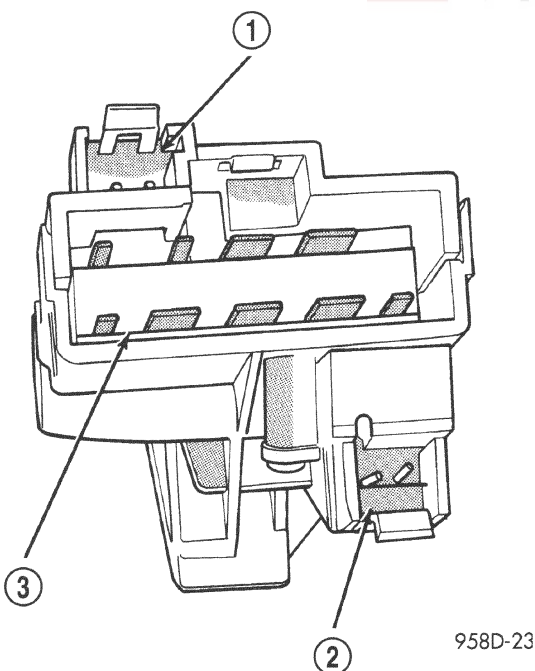


Fig. 27 Ignition Switch Connectors

- 1 - KEY IN SWITCH
- 2 - PRNDL SWITCH
- 3 - IGNITION SWITCH

958D-23

(7) Check for proper operation of ignition switch and key-in warning switch.

## LOCK KEY CYLINDER

## REMOVAL

(1) Disconnect negative cable from auxillary jumper terminal.

(2) Remove upper steering column shroud.

(3) Pull lower shroud down far enough to access lock cylinder retaining tab.

(4) Place key cylinder in RUN position. Depress retaining tab and remove key cylinder (Fig. 29).

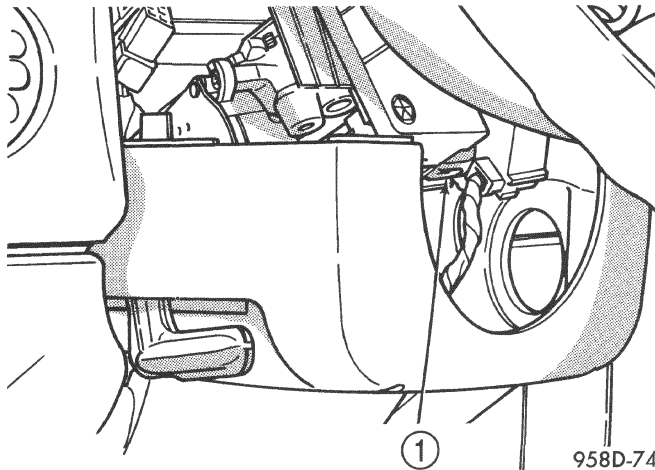
## INSTALLATION

(1) Install key in lock cylinder. Turn key to run position (retaining tab on lock cylinder can be depressed).

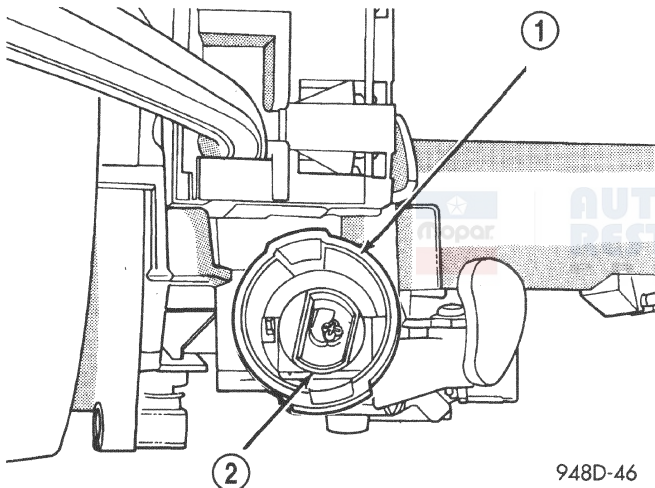
(2) The shaft at the end of the lock cylinder aligns with the socket in the end of the housing. To align the socket with the lock cylinder, ensure the socket is in the Run position (Fig. 30).

(3) Align the lock cylinder with the grooves in the housing. Slide the lock cylinder into the housing until the tab sticks through the opening in the housing.



**REMOVAL AND INSTALLATION (Continued)****Fig. 29 Lock Cylinder Retaining Tab**

1 - LOCK CYLINDER RETAINING TAB

**Fig. 30 Socket in Lock Cylinder Housing**1 - LOCK CYLINDER HOUSING  
2 - SOCKET

(4) Turn the key to the Off position. Remove the key.

(5) Install steering column shrouds.

(6) Connect negative cable to auxillary battery terminal on shock tower.

**IGNITION INTERLOCK**

Refer to the Transaxle section for Shifter/Ignition Interlock Service.

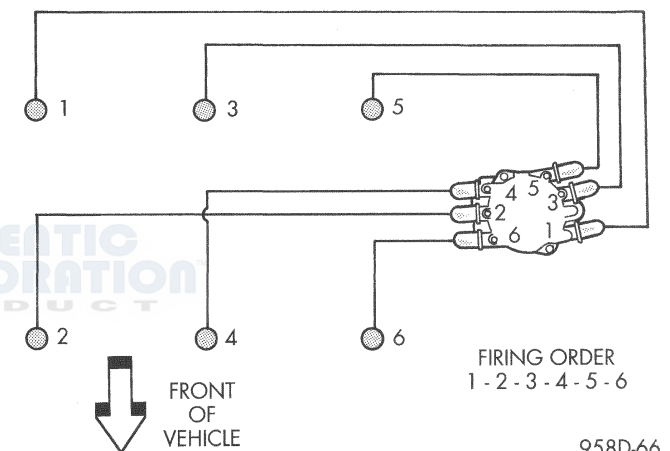
**LOCK CYLINDER HOUSING**

Refer to Steering Column in Group 19, Steering, for Lock Cylinder Housing Service.

**SPECIFICATIONS****VEHICLE EMISSION CONTROL INFORMATION LABEL****DESCRIPTION**

All models have a Vehicle Emission Control Information (VECI) Label. Chrysler permanently attaches the label in the engine compartment. It cannot be removed without defacing information and destroying the label.

The label contains the vehicle's emission specifications and vacuum hose routings. All hoses must be connected and routed according to the label.

**FIRING ORDER**FIRING ORDER  
1-2-3-4-5-6

958D-66

**FIRING ORDER—2.5L****TORQUE SPECIFICATION****DESCRIPTION****TORQUE**

Air Inlet tube Clamp . . . . . 3 N·m (25 in. lbs.)

Camshaft Position Sensor Screw . . . . . 12 N·m  
(105 in. lbs.)

Coolant Sensor—2.5L . . . . . 27 N·m (20 ft. lbs.)

Crankshaft Position Sensor Screw . . . . . 12 N·m  
(105 in. lbs.)

Coolant Temp. Sensor . . . . . 18.6 N·m (165 in. lbs.)

Distributor Holddown Nut—2.5L . . . . . 13 N·m  
(9 ft. lbs.)

EGR Tube to Intake . . . . . 11 N·m (95 in. lbs.)

IAT Sensor—2.5L . . . . . 11.5 N·m (100 in. lbs.)

Knock Sensor . . . . . 10 N·m (90 in. lbs.)

MAP Sensor—2.5L . . . . . 3.4 N·m (30 in. lbs.)

Spark Plugs . . . . . 28 N·m (20 ft. lbs.)

**SPECIFICATIONS (Continued)****SPARK PLUG CABLE RESISTANCE—2.5L**

MINIMUM	MAXIMUM
250 Ohms Per Inch	560 Ohms Per Inch
3000 Ohms Per Foot	6700 Ohms Per Foot

**SPARK PLUGS**

Engine	Spark Plug	Gap	Thread Size
2.4L	RC12YC5	0.048 TO 0.053	14mm (3/4 in.) reach
2.5L	RC10PYP4	0.038 TO 0.043	14mm (3/4 in.) reach

**IGNITION COIL**

Engines	Coil Manufacture	Primary Resistance at 21°C-27°C (70°F-80°F)	Secondary Resistance at 21°C-27°C (70°F-80°F)
2.5L	Melco	0.6 TO 0.8 Ohms	12,500 to 18,000 Ohms



**AUTHENTIC  
RESTORATION™**  
PRODUCT

# INSTRUMENT PANEL SYSTEMS

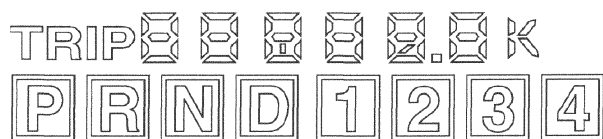
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## DESCRIPTION AND OPERATION

### AUTOSTICK

#### DESCRIPTION



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**Fig. 1 Autostick Odometer/Transmission Range Indicator**

Vehicles with Autostick will have a unique Transmission Range Indicator display.

### OPERATION

When in the Autostick mode, a box around the gear position will be displayed to inform the driver which transmission gear is currently engaged.

### COMPASS/TEMPERATURE MINI-TRIP COMPUTER (CMTC)

#### DESCRIPTION

The Compass / Temperature Mini-Trip Computer (CMTC) system is located on the right hand side of the instrument panel cluster (Fig. 2).

The CMTC is an electronic control module with a vacuum fluorescent display and two function buttons. The CMTC is capable of displaying compass, temperature, and trip computer information (Fig. 3).

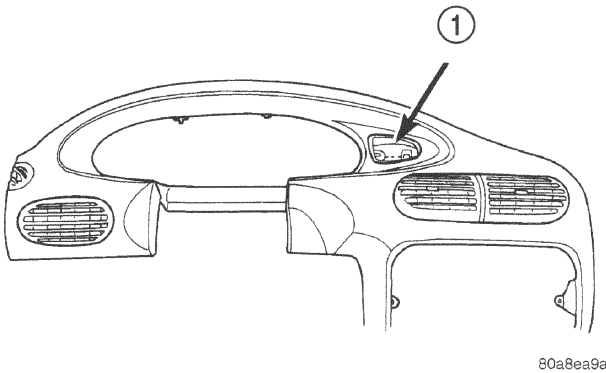
The functions that are available via activation of the STEP switch are as follows:

- Compass and Ambient Temperature



**DESCRIPTION AND OPERATION (Continued)**

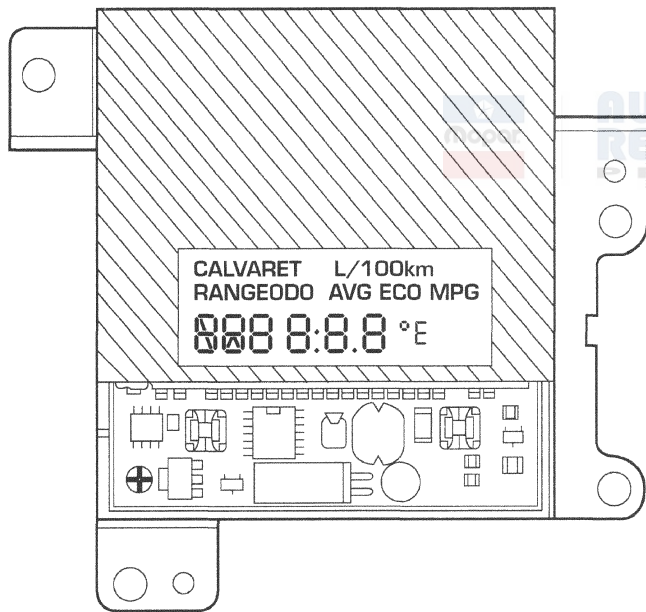
- Average Trip Fuel Economy (AVG ECO)
- Estimated Range (RANGE)
- Present Fuel Economy (ECO)
- Trip Odometer (ODO)
- Elapsed Ignition On Time (ET)
- Blank Screen



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**Fig. 2 Compass/Temperature Mini-Trip Computer**

1 - TEMPERATURE/COMPASS MINI TRIP COMPUTER



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**Fig. 3 Compass/Temperature Mini-Trip Computer Module****OPERATION**

Actuation of the STEP button will cause the CMTC to change mode of operation and actuation of the US/M button will toggle between English and Metric unit of measurement. A reset of the trip computer information is accomplished by actuating the Step and US/M buttons simultaneously.

The CMTC is active only when the ignition switch is in the ON position. When the ignition switch is turned ON, the CMTC will turn on all of the segments in the display for one second then return to

the last function screen that was displayed prior to the ignition being turned OFF.

**COMPASS**

The CMTC requires no activation of any switches to trigger a forced calibration. The compass is initially setup to be calibrated for earth fields of approximately 180 milligauss. However, due to the variation in the magnetic earth field across the country and the variation of the magnetic structure from vehicle to vehicle the compass may need to be calibrated. Refer to Compass Calibration Service Procedures.

**AMBIENT TEMPERATURE**

The temperature is displayed in whole degrees Celsius or Fahrenheit. Temperatures greater than or equal to zero are displayed unsigned and temperatures below zero are displayed signed (-). If the temperature is more than 55°C (131°F) or the temperature sending line is shorted to ground, the compass and ambient temperature screen will display SC. If the temperature is less than -40°C (-40°F) or the temperature sending line is an open circuit, the compass and ambient temperature screen will display "OC". If the CMTC is not receiving the temperature information over the CCD Bus, then the compass and ambient temperature screen will display "CCd". Refer to the proper Body Diagnostics Procedures Manual.

**MINI TRIP COMPUTER MESSAGES**

The Mini Trip Computer data is obtained from information put on the CCD bus from the Powertrain Control Module (PCM) and the Body Control Module (BCM). The CMTC will not display information for any of the screens for which it did not receive the proper data over the CCD bus for that particular screen. In this case the message "CCd" will be displayed. If some of the screens appear to be functioning properly but some of the screens display "CCd" then check either the Powertrain Control Module or the Body Control Module for proper CCD bus communications. If the "CCd" message still persists, refer to the Mini Trip Computer Self Diagnostic Test.

**ELECTRO/MECHANICAL INSTRUMENT CLUSTER****DESCRIPTION**

The mechanical instrument cluster is an electro/mechanical module which receives most of its information from the Body Control Module (BCM) via the CCD bus.

The cluster (Fig. 4) includes:

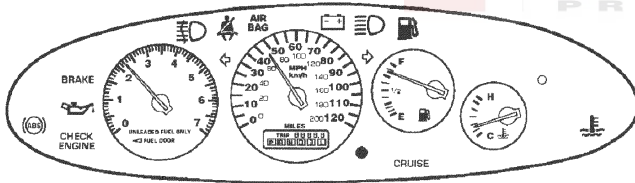
- 120 mph (200) km/h speedometer
- Tachometer

## DESCRIPTION AND OPERATION (Continued)

- Odometer / trip odometer and transmission range indicator with automatic transmission
- Door ajar
- Deck ajar
- Lo washer fluid
- Fuel gauge
- Temperature gauge
- Vehicle Theft / Security System (VTSS) indicator (optional)

The warning and information indicators include the following:

- Check Engine
- Airbag
- Charging system
- Low oil pressure
- High temperature
- Low fuel
- Seat belt
- Cruise (optional)
- Brake/park brake
- Anti-lock brake system (optional)
- High beam
- Fog lamps
- Vehicle Theft / Security System (VTSS) indicator (optional)
- Turn signals
- Traction Control ON/OFF



80b11952

Fig. 4 Instrument Cluster

## OPERATION

The gauges are the magnetic air-core type. When the ignition switch is OFF, the gauge pointers should rest at or below the low graduation.

It receives most of its information from the Body Control Module (BCM) via the CCD bus.

## DIAGNOSIS AND TESTING

### DIAGNOSTIC PROCEDURE

In order to diagnose the instrument cluster function, a DRB III® scan tool and the proper Body Diagnostic Procedures Manual are required.

As a quick diagnosis, the cluster can perform a function check for the electronic display, odometer and transmission range indicator, and all warning lamps will illuminate for a brief period of time except:

- Cruise

- Fog lamps
- High beam
- Low fuel
- Low oil pressure
- Turn signal
- Security alarm
- Brake
- Trac OFF

If the cluster is not receiving CCD bus messages, the cluster will appear nonfunctional except for the continuously illuminated airbag indicator and NO BUS message displayed.

If the cluster is not receiving CCD bus messages, refer to the pre-diagnostic test described in proper Body Diagnostic Procedures Manual or refer to the Instrument Cluster Self-Diagnostic Test below.

## INSTRUMENT CLUSTER SELF- DIAGNOSTICS

Initiate instrument cluster self-diagnostic by depressing the odometer/trip reset button while turning the ignition key to the OFF and then the RUN position. This will cycle an electronic display segment check and illumination in sequence of all CCD bus activated cluster warning indicators. There are four Check (CHEC) functions:

- (1) CHEC 1, checks the gauges.
- (2) CHEC 2, checks the warning lamps.
- (3) CHEC 3, checks the odometer/trip meter.
- (4) CHEC 4, Transmission Range Indicator for the automatic transmission or the autostick transmission.

If the diagnostic procedure determines that a replacement of an instrument cluster component is required, refer to the proper component removal procedure.

### CHEC 1

- (1) If all gauges fail to move, replace Cluster Printed Circuit (PC) Board.
- (2) If any gauge fails to move, replace the gauge assembly.
- (3) If any gauge(s) is not in the proper position, replace Cluster Printed Circuit Board.

### CHEC 2

- (1) If any lamp does not light, check lamp.
- (2) If lamp is not OK, replace lamp.
- (3) If lamp is OK, replace Cluster Printed Circuit Board.

### CHEC 3

If any V/F segment does not light, replace Odometer/Transmission Range Indication.

**DIAGNOSIS AND TESTING (Continued)****CHEC 1 - GAUGE DISPLAY**

TACHOMETER ...6000 RPM
SPEEDOMETER ...100 MPH (220 KM/H)
FUEL GAUGE POINTER ON ...F
TEMPERATURE GAUGE POINTER ON ...H
TACHOMETER ...3000 RPM
SPEEDOMETER ...75 MPH (120 KM/H)
FUEL GAUGE POINTER ON ...1/2
TEMPERATURE GAUGE POINTER ON ...MIDSCALE
TACHOMETER ...3000 RPM
SPEEDOMETER ...55 MPH (100 KM/H)
FUEL GAUGE POINTER ON ...1/2
TEMPERATURE GAUGE POINTER ON ...MIDSCALE
TACHOMETER ...1000 RPM
SPEEDOMETER ...20 MPH (40 KM/H)
FUEL GAUGE POINTER ON ...E
TEMPERATURE GAUGE POINTER ON ...C

**CHEC 2 - WARNING LAMP DISPLAY**

CHECK ENGINE
SEAT BELT
AIRBAG
CHARGING SYSTEM
LOW FUEL
HIGH BEAM INDICATOR
ENGINE TEMPERATURE
CRUISE
ANTI-LOCK BRAKE
TRAC ON

**CHEC 4 - AUTOMATIC TRANSMISSION**

If any V/F segment does not light, replace Odometer/Transmission Range Indication.

**CHEC 4 - AUTOMATIC TRANSMISSION**

If any V/F segment does not light, replace Odometer/Transmission Range Indication.

**COMPASS / TEMPERATURE MINI - TRIP COMPUTER (CMTC) SELF - DIAGNOSTICS**

The CMTC is capable of performing a diagnostic self check on many of its internal functions. CMTC diagnostics may be performed using a DRB III® scan

**CHEC 3 - VACUUM FLORESCENT (VF) DISPLAY**

TRIP
ODOMETER CENTER
ODOMETER LOWER RIGHT
ODOMETER BOTTOM
ODOMETER LOWER LEFT
ODOMETER UPPER LEFT
ODOMETER TOP
ODOMETER UPPER RIGHT
ALL ODOMETER V/F DISPLAY DIGIT SEGMENTS ON

**CHEC 4 - TRANSMISSION RANGE (VF) DISPLAY - AUTOMATIC TRANSMISSION**

PRND3L
PRND3L AND BOX AROUND P
PRND3L AND BOX AROUND R
PRND3L AND BOX AROUND N
PRND3L AND BOX AROUND D
PRND3L AND BOX AROUND 3
PRND3L AND BOX AROUND L
PRND3L AND ALL BOXES
END

**TRANSMISSION RANGE (VF) DISPLAY - AUTOSTICK**

PRND1234
PRND1234 AND BOX AROUND 1
PRND1234 AND BOX AROUND 2
PRND1234 AND BOX AROUND 3
PRND1234 AND BOX AROUND 4
PRND1234 AND BOX AROUND P
PRND1234 AND BOX AROUND R
PRND1234 AND BOX AROUND N
PRND1234 AND BOX AROUND D
PRND1234 AND ALL BOXES
END

tool and the proper Body Diagnostic Procedures Manual or by the following procedure.

(1) With the ignition switch in the OFF position, press both the US/M and STEP button.



## DIAGNOSIS AND TESTING (Continued)

(2) Turn ignition switch to the ON position.

The CMTC will perform internal checks while lighting all segments of the vacuum florescent display. Upon completion of the internal check, the CMTC will display one of three messages;

- PASS
- FAIL
- CCd

If any segment of the CMTC fails to light replace the module.

If FAIL is displayed, repeat the test. If it still fails, replace the module.

If CCd is displayed, check the CCD and Body Control Module (BCM) for proper operation, refer to the appropriate diagnostic test procedures manual. If the CCD and the BCM are OK, replace the CMTC module.

For additional diagnostic information on the CMTC and for identifying CMTC problems, refer to the proper Body Diagnostic Procedures Manual.

## TRACTION CONTROL SWITCH

For diagnosis and testing of the Traction Control Switch, refer to the proper ABS Diagnostic Procedures Manual.

For diagnosis and testing of the Traction Control cluster lamp, refer to the proper Body Diagnostic Procedures Manual.

## SERVICE PROCEDURES

### COMPASS CALIBRATION PROCEDURE

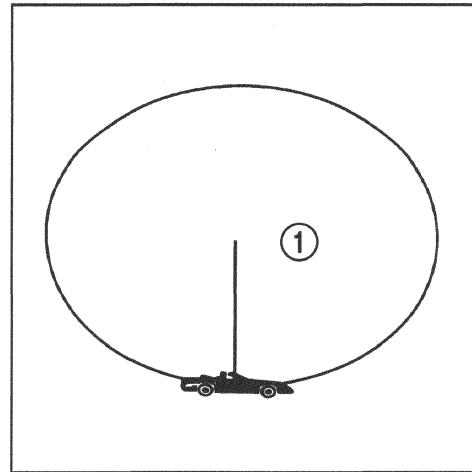
#### COMPASS CALIBRATION

The compass must be calibrated to guarantee proper operation. Calibration should take place on a level surface in an area free of large metal objects, such as other vehicles, large buildings, bridges, underground cables, railroad tracks, etc.

If the "CAL" indicator is lit, the compass should be calibrated. The vehicle will be shipped with the "CAL" light on. Under certain conditions the "CAL" light may also come on during driving. Also, during normal driving, the compass may appear inaccurate, and the "CAL" indicator may or may not come on. In either condition, calibration is required.

To calibrate the compass (Fig. 5), drive in complete circles at a speed of 7–10 mph, until the "CAL" indicator is off (2–6 turns). If the "CAL" indicator is not on, prior to calibrating the compass, the "CAL" light will come on for a few seconds to indicate it has been calibrated. When the "CAL" indicator goes off, the compass is calibrated and should display correct headings (for all conditions). Verify proper calibration by checking North (N), South (S), East (E), and West

(W). If the compass does not appear accurate, repeat the calibration procedure in another area.



**Fig. 5 Compass Calibration**

80b9a4bf

1 - radius = 15' — 45'  
speed = 7–10 mph

**NOTE:** Drive in a small circle (try to keep steering wheel in a fixed position) between 7–10 mph, until the "CAL" light goes off.

## VARIANCE SETTING PROCEDURE

Variance is the difference between magnetic North and geographic North. To adjust the compass variance set the CMTC to Compass/Temperature mode and press both US/M and STEP buttons for up to one second. The symbol VAR and current variance zone number will be displayed. Press the STEP button until the variance setting for your location is displayed (Fig. 6). After five seconds of inactivity, the displayed zone will be automatically set and normal operation resumed in the Compass/Temperature mode.

## REMOVAL AND INSTALLATION

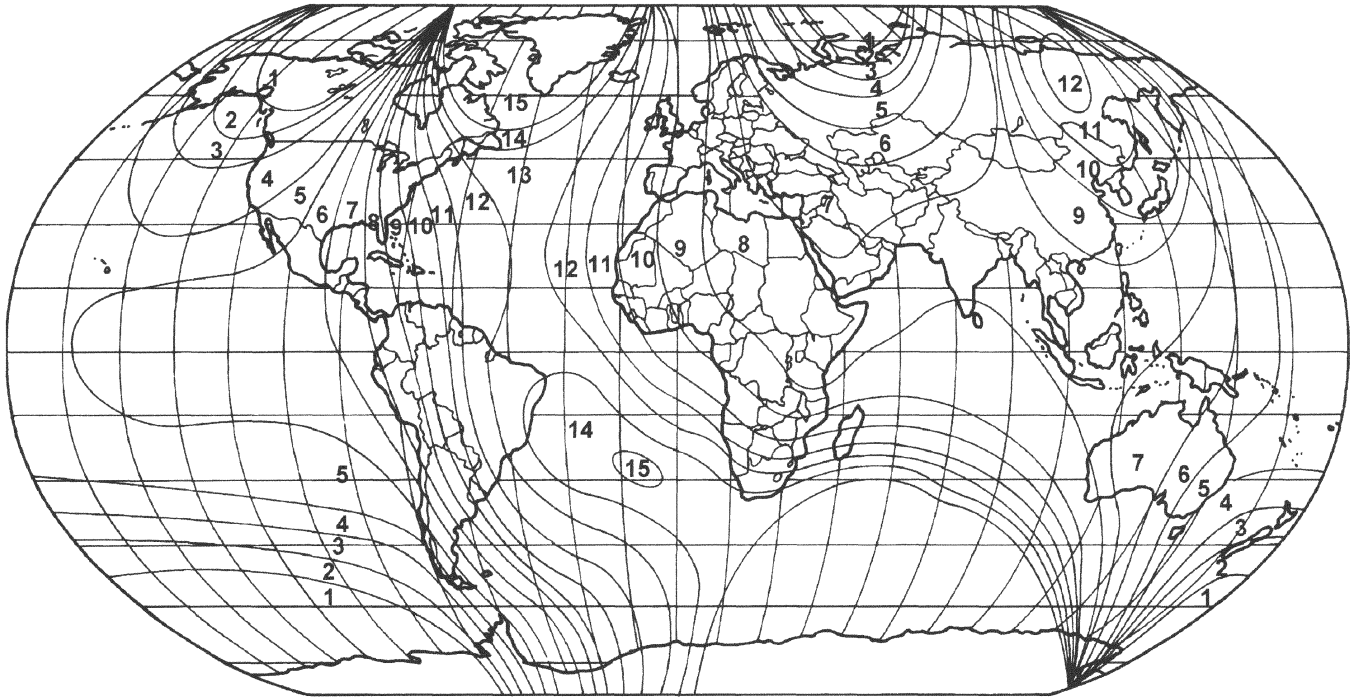
### BODY CONTROL MODULE (BCM)

#### REMOVAL

(1) Disconnect the remote battery negative cable from the terminal on the shock tower.

The Junction Block and Body Control Module (BCM) are attached to each other. After removal they can be separated.

(2) Remove Junction Block / Body Control Module from vehicle. Refer to Group 80, Power Distribution Systems for Removal and Installation.

**REMOVAL AND INSTALLATION (Continued)**

80a13863

**Fig. 6 Variance Settings**

(3) With the Junction Block/BCM removed from the vehicle, separate the BCM from the Junction Block.

(4) Remove the two BCM attaching screws and release the two BCM locking latches from the Junction Block.

(5) Disconnect BCM from the Junction Block.

**NOTE:** The Remote Keyless Entry (RKE) module is attached to the BCM with three screws. This must be transferred (if equipped) to the new BCM if being replaced.

**NOTE:** If BCM is replaced, the VTSS must be enabled in the new BCM via the DRB III® in order to start the vehicle.

**INSTALLATION**

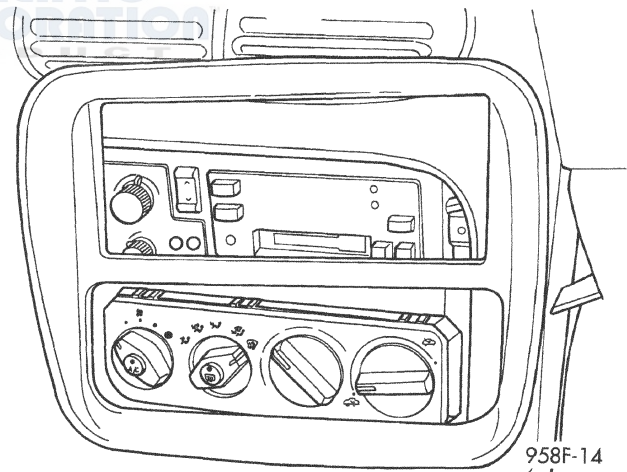
For installation, reverse the above procedures.

**CENTER BEZEL****REMOVAL**

Pull center bezel straight rearward along the sides of the radio and A/C control openings to disengage five clips (Fig. 7).

**INSTALLATION**

For installation, reverse the above procedures.

**Fig. 7 Center Bezel****CIGAR LIGHTER / POWER OUTLET****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable (Fig. 11).

(2) Remove cubby bin. Refer to Cubby Bin / Lamp Removal and Installation in this section.

(3) Disconnect the two wiring connectors from cigar lighter / power outlet. Unscrew shell and clamp assembly to replace.



## REMOVAL AND INSTALLATION (Continued)

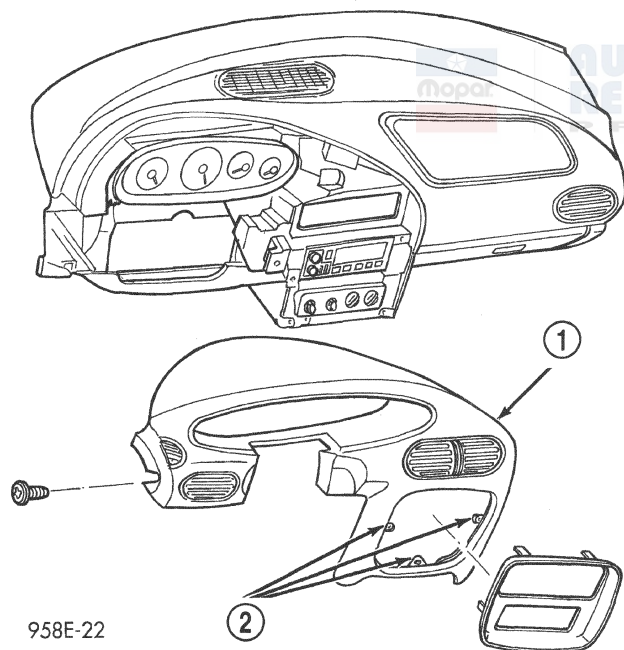
### INSTALLATION

For installation, reverse the above procedures. The clamp has a locating feature. The cubby bin must engage the console at its forward edge prior to installing the mounting screws.

### CLUSTER HOOD

#### REMOVAL

- (1) Remove instrument panel left end cap.
- (2) Tilt steering column down to its lowest position.
- (3) Remove instrument panel center bezel by disengaging the four clips (Fig. 7).
- (4) Remove four attaching screws under the center bezel.
- (5) Remove screw at left end of panel.
- (6) Pull hood straight back to disengage the eight clips. If equipped with a Compass/Temperature Mini Trip Computer pull rearward about 3 inches and stop. Reach through the radio opening in the cluster hood and disconnect the CMTC wire connector.
- (7) Remove instrument cluster hood (Fig. 8).



**Fig. 8 Instrument Cluster Hood**

- 1 - INSTRUMENT CLUSTER HOOD  
2 - ATTACHING SCREWS

#### INSTALLATION

For installation, reverse the above procedures. Keep the forward edge of the hood down on the instrument panel while sliding the hood forward to engage the retaining clips.

### CLUSTER LAMPS

The Instrument Cluster must be removed to service the cluster lamps. Refer to Instrument Cluster Removal and Installation in this section.

Refer to (Fig. 9) for appropriate lamp locations. Replace fog lamp indicator lamp, ABS indicator lamp and security LED socket assembly only if equipped.

All lamps are part #194 except for Fog Lamp (#161) and Security LED (#4608419).

### CLUSTER PRINTED CIRCUIT BOARD

**NOTE: White faced cluster is an electroluminescent unit and uses no illumination lamps. This cluster is not servicable and must be replaced as a unit.**

The Instrument Cluster must be removed to service the cluster printed circuit board. Refer to Instrument Cluster Removal and Installation in this section.

#### REMOVAL

- (1) Remove six cluster back cover retaining screws and remove the cover.
- (2) Disconnect odometer/transmission range indicator connector from the printed circuit board.
- (3) Remove nine printed circuit board attaching screws and remove. There are two screws located at the base of each connector (Fig. 10).

#### INSTALLATION

For installation, reverse the above procedures.

### COMPASS / TEMPERATURE MINI - TRIP COMPUTER (CMTC) MODULE

#### REMOVAL

- (1) Disconnect and isolate the battery negative remote cable (Fig. 11).
- (2) Remove the Cluster Hood. Refer to Cluster Hood Removal and Installation in this section.
- (3) With the cluster hood removed, remove the four screws attaching the CMTC Module (Fig. 12).
- (4) Remove CMTC Module from cluster hood.

#### INSTALLATION

For installation, reverse the above procedures.

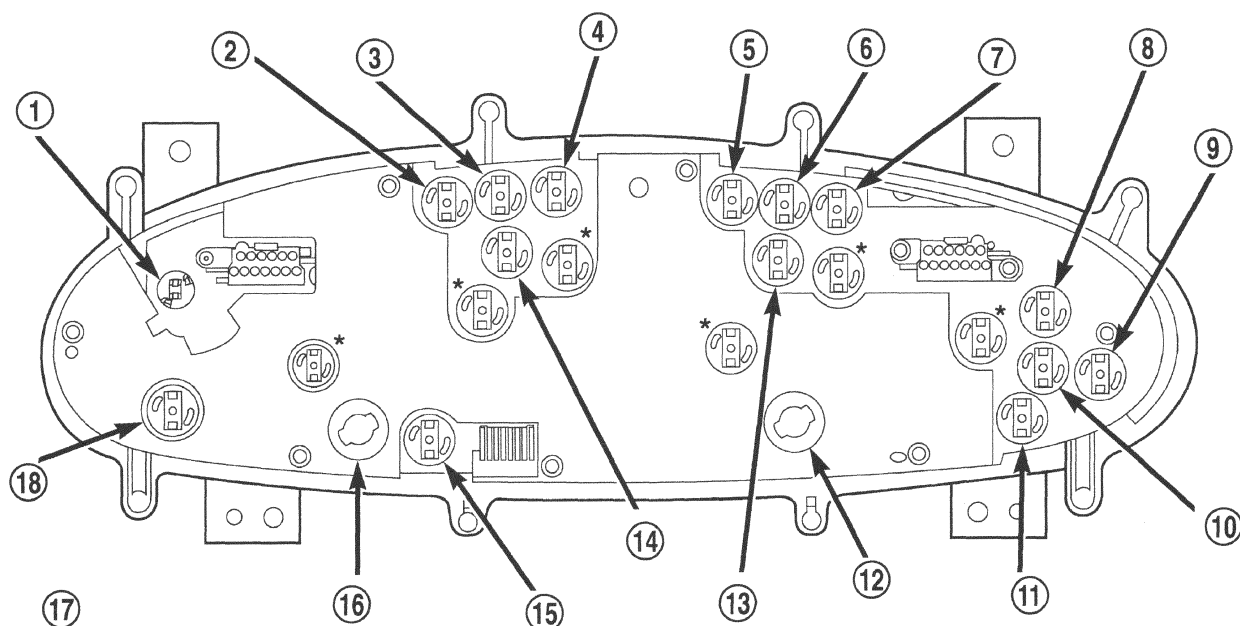
### CUBBY BIN/LAMP

#### REMOVAL

- (1) Disconnect and isolate the battery negative cable remote terminal from the shock tower.
- (2) Remove center bezel.
- (3) Remove instrument cluster hood screws.
  - (a) Remove two screws adjacent radio.



## REMOVAL AND INSTALLATION (Continued)

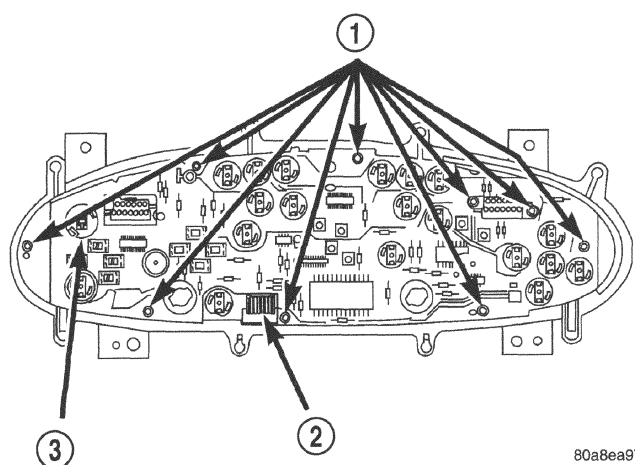


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Fig. 9 Lamp Location

- 1 - VEHICLE THEFT SECURITY SYSTEM LED
- 2 - LOW FUEL
- 3 - HIGH BEAM
- 4 - CHARGING SYSTEM
- 5 - AIR BAG
- 6 - SEAT BELT
- 7 - FOG LAMP
- 8 - BRAKE
- 9 - ABS

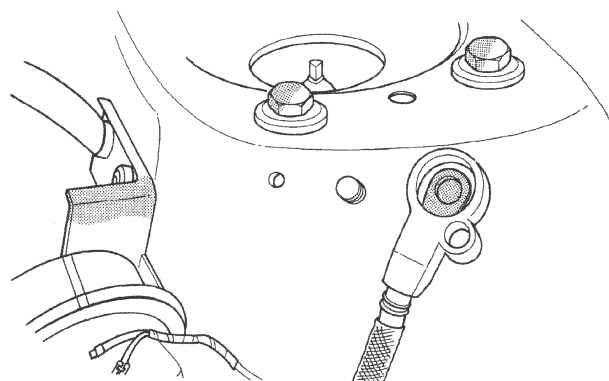
- 10 - OIL PRESSURE
- 11 - MIL/CHECK ENGINE
- 12 - TRAC OFF
- 13 - LEFT TURN
- 14 - RIGHT TURN
- 15 - CRUISE
- 16 - TRAC ON
- 17 - \*ILLUMINATION LAMP
- 18 - HI TEMP



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Fig. 10 Printed Circuit Board

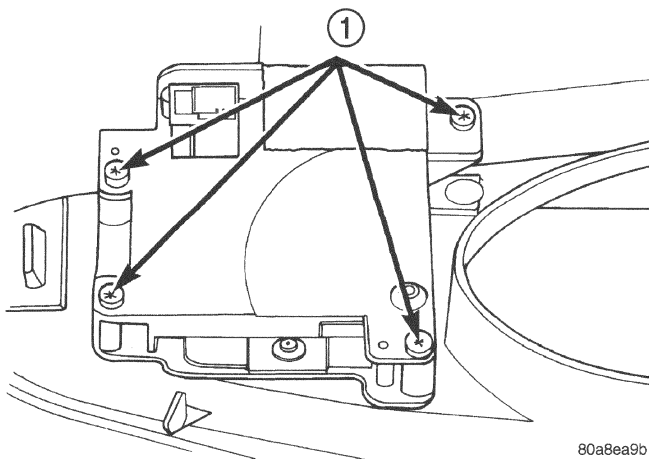
- 1 - RETAINING SCREWS
- 2 - TRANSMISSION RANGE INDICATOR CONNECTOR
- 3 - VTSS LED



958A-18

Fig. 11 Battery Negative Remote Cable Removal

- (b) Remove screw below HVAC control in the center.
- (c) Remove screw at left end of panel.
- (d) Flex instrument cluster hood slightly to give access to the cubby bin screws.
- (4) Remove the cubby bin mounting screws and remove bin.

**REMOVAL AND INSTALLATION (Continued)****Fig. 12 CMTC Module**

1 - REMOVE SCREWS

**INSTALLATION**

For installation, reverse the above procedures. The cubby bin must engage the console at its forward edge prior to installing the mounting screws.

**FUEL GAUGE AND TEMPERATURE GAUGE**

The Instrument Cluster must be removed to service the Fuel Gauge and Temperature Gauge. Refer to Instrument Cluster Removal and Installation in this section.

**REMOVAL**

- (1) Remove mask/lens retaining screws and remove mask/lens (Fig. 13).
- (2) Disconnect odometer / transmission range indicator connector from the printed circuit board (Fig. 14).
- (3) Remove screws attaching speedometer / tachometer to housing and remove (Fig. 15).
- (4) Remove the fuel / temperature gauge attaching screws from the housing and remove (Fig. 16).

**INSTALLATION**

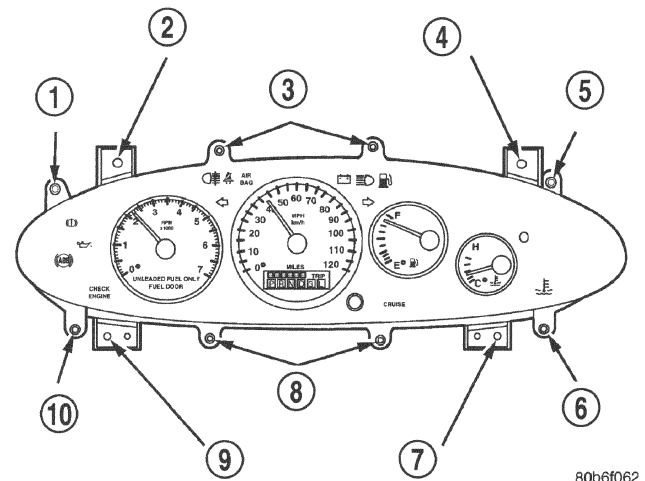
For installation, reverse the above procedures.

**GLOVE BOX DOOR HANDLE****REMOVAL**

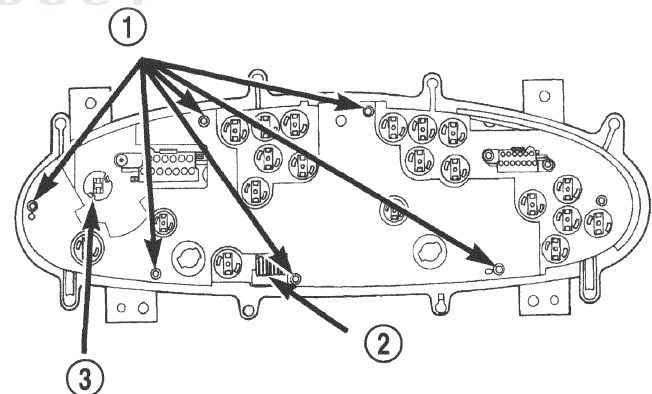
- (1) Open glove door.
- (2) Remove four door handle attaching screws.
- (3) Remove handle.

**INSTALLATION**

For installation, reverse the above procedures.

**Fig. 13 Mask/Lens Retaining Screws**

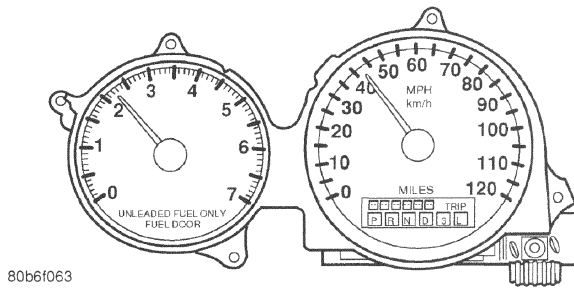
- 1 - MASK/LENS SCREWS
- 2 - CLUSTER SCREWS
- 3 - MASK/LENS SCREWS
- 4 - CLUSTER SCREWS
- 5 - MASK/LENS SCREWS
- 6 - MASK/LENS SCREWS
- 7 - CLUSTER SCREWS
- 8 - MASK/LENS SCREWS
- 9 - CLUSTER SCREWS
- 10 - MASK/LENS SCREWS

**Fig. 14 Back Cover Retaining Screws**

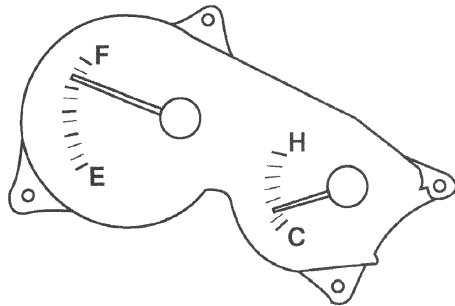
- 1 - CLUSTER BACK COVER RETAINING SCREWS
- 2 - ODOMETER/TRANSMISSION RANGE INDICATOR CONNECTOR
- 3 - VTSS LED

**GLOVE BOX DOOR LOCK****REMOVAL**

- (1) Remove glove box door handle.
- (2) Insert the proper key in lock cylinder, depress the gray locking key on back side housing at the 3 O'clock position.

**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 15 Speedometer/Tachometer**

80b61064

**Fig. 16 Fuel Gauge and Temperature Gauge**

(3) Rotate the key clockwise to disengage cylinder from housing.

**INSTALLATION**

For installation, reverse the above procedures.

**HEADLAMP SWITCH**

The Headlamp Switch is part of the Multi-Function Switch. Refer to Group 8J, Turn Signal and Flashers for Diagnosis and Testing (Multi-Function Switch Test), and Removal and Installation.

**HVAC CONTROL****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable.

(2) Remove center bezel by pulling rearward to disengage four clips and remove attaching screws from cubby bin.

(3) Remove the HVAC control attaching screws. Pull the control out to disconnect two electrical connectors and two control cables. Remove HVAC control.

**INSTALLATION**

For installation, reverse the above procedures. The forward edge of bin must engage the forward console.

**INSTRUMENT CLUSTER**

To service any instrument cluster component, the instrument cluster must be removed from the instrument panel.

**REMOVAL**

(1) Disconnect and isolate the battery negative remote cable (Fig. 11).

(2) Remove instrument cluster hood, refer to Cluster Hood Removal and Installation in this section.

(3) Remove the four cluster attaching screws (Fig. 13).

(4) Remove instrument cluster and disconnect wire connectors from instrument panel by pulling cluster rearward.

**INSTALLATION**

For installation, reverse the above procedures.

**INSTRUMENT PANEL and PAD ASSEMBLY**

**WARNING: DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE BEFORE BEGINNING ANY AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURE. THIS WILL DISABLE THE AIRBAG SYSTEM.**

**FAILURE TO DISCONNECT BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**

**ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR 2 MINUTES BEFORE REMOVING ANY AIRBAG COMPONENTS.**

**REMOVAL**

When removing a passenger airbag module refer to Group 8M, Passive Restraint Systems for Passenger Air Bag Module Removal and Installation.

(1) Disconnect and isolate the battery negative remote cable.

(2) Open both vehicle front doors. Remove left end cover by pulling outboard. Remove right end cover by pulling rearward (Fig. 17).

(3) Remove shift knob and transmission range indicator bezel from floor console. Use care not to mar the bezel or console.

(4) Remove floor center console. Remove two mounting screws in the front and two mounting screws under the decorative caps in the rear.

(5) Using a trim stick (special tool #C-4755), gently pry out on center instrument panel trim bezel and remove.

(6) Remove instrument cluster hood.

(a) Remove two screws adjacent radio.

(b) Remove the the two screws below HVAC control.

(c) Remove screw at left end of panel.

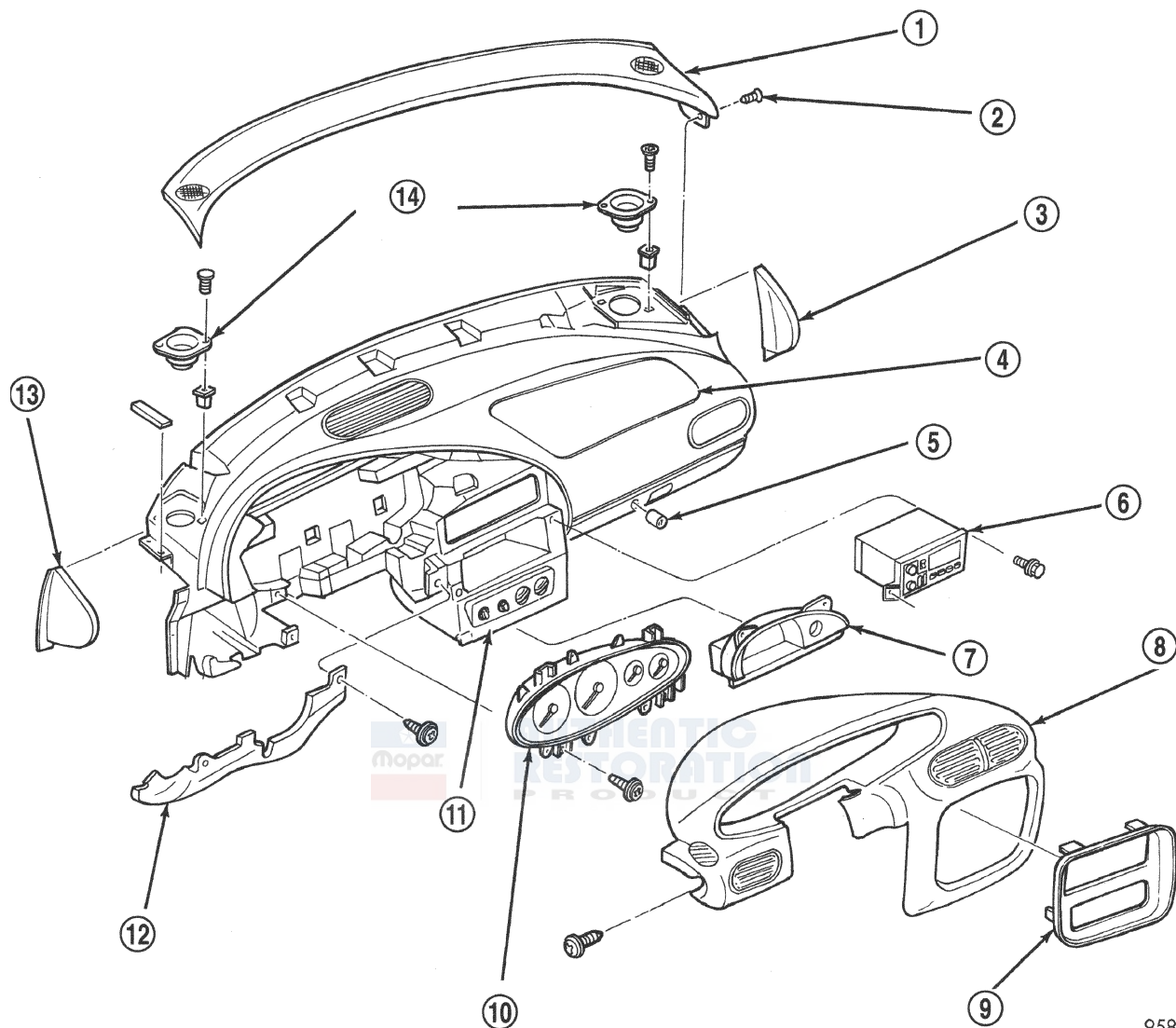
(d) Pull on hood to disengage the eight clips.

(7) Remove two cubby bin screws and remove.

(8) Remove five knee bolster mounting screws.



## REMOVAL AND INSTALLATION (Continued)



958E-23

**Fig. 17 Instrument Panel Breakdown**

- 1 - TOP COVER
- 2 - SCREW
- 3 - END COVER
- 4 - PASSENGER AIRBAG MODULE
- 5 - GLOVE BOX LOCK CYLINDER
- 6 - RADIO
- 7 - CUBBY BIN

- 8 - INSTRUMENT CLUSTER HOOD
- 9 - CENTER BEZEL
- 10 - INSTRUMENT CLUSTER
- 11 - HVAC
- 12 - KNEE BOLSTER
- 13 - END COVER
- 14 - SPEAKERS

(9) Open glove box door and press sidewalls inboard while pulling the back panel rearward to lower door from panel to access forward floor console.

(10) Remove forward floor console eight attaching screws and one push pin at forward driver's side.

(11) Disconnect Airbag Control Module (ACM) and wiring connectors at center console.

(12) Pull the driver's under panel silencer outboard off the distribution duct.

(13) Remove left and right A-pillar moldings, starting from the top edge and pulling them out.

(14) Remove instrument panel top cover attaching screw on passenger side.

(a) Lift the right rear edge of top cover to disengage the vertical clips along the rear edge. Proceeding from right to the left side. Do not use a nylon trim stick, to avoid marring cover or panel.

(b) Lift rear edge and slide top cover rearward disengaging angular clips and remove cover.

**REMOVAL AND INSTALLATION (Continued)**

- (15) Remove HVAC control attaching screws.
- (16) Disconnect wire harness connectors and control cables from HVAC control head.
- (17) Remove center distribution duct screws from behind radio and duct.
- (18) Remove radio. Access and remove the three HVAC attaching screws to duct and panel. Remove the three HVAC attaching bolts from the cross-car beam.
- (19) Close glove box door.
- (20) Remove five screws attaching panel to plenum.
- (21) Remove steering column shrouds.
- (22) Disconnect steering column wiring connectors.
- (23) Disconnect shift interlock cable.
- (24) Remove four steering column retaining nuts and lower column to floor.
- (25) Disconnect engine and body wire harness from Junction Block/BCM.
- (26) Remove one push pin to right underpanel silencer.
- (27) Remove fasteners:
  - Four at left end and three at the right end of the cross car beam
  - Two at steering column plenum
  - One at glove box hinge to A-pillar
  - Two at center support to the floor pan bracket
- (28) Remove attaching screw at the rear of HVAC to the center support bracket.
- (29) With the help of an assistant, lift up instrument panel and move rearward to remove.

**INSTALLATION**

For installation, reverse the above procedures. DO NOT CONNECT battery negative remote cable. Refer to Group 8M, Restraint Systems for Air Bag System test.

**INSTRUMENT PANEL END COVERS – LEFT AND RIGHT****REMOVAL**

- (1) Open the left door and pull on the access handle and pivoting around A-pillar to disengage end cover clips. Fuse Puller, Spare Fuses And Fuse Diagram Are Located On Left End Cover. Fuse Access Is Under Left End Cover (Fig. 17).
- (2) Open right door and glove box door.
- (3) Remove right end cover by pulling rearward to disengage clips.

**INSTALLATION**

For installation, reverse the above procedures. Ensure spare fuses are seated to left end cover.

**INSTRUMENT PANEL SPEAKERS****REMOVAL**

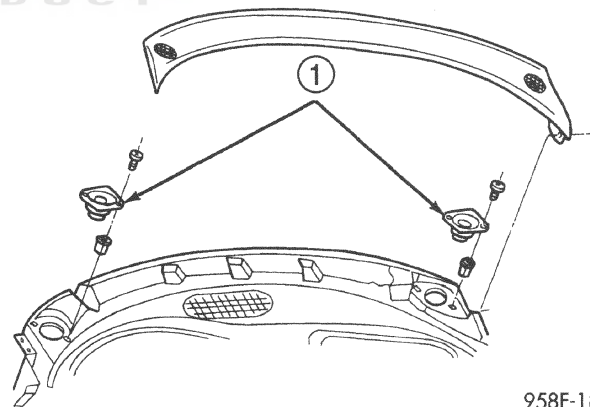
- (1) Disconnect and isolate the battery negative remote cable (Fig. 11).
- (2) Remove instrument panel top cover, refer to Instrument Panel Top Cover Removal and Installation in this section.
- (3) Remove two screws on each speaker and lift up, disconnect wiring connector and remove speaker.

**INSTALLATION**

For installation, reverse the above procedures

**INSTRUMENT PANEL TOP COVER****REMOVAL**

- (1) Open glove box door.
- (2) Remove right end cap and remove screw at right end.
- (3) Using a trim stick (special tool #C-4655), gently pry out and remove both left and right A-pillar trim moldings.
- (4) Lift the right rear edge of top cover to disengage the clips along the rear edge. Proceeding from right to the left side. Do not use a nylon trim stick, to avoid potential damage (Fig. 18).



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**Fig. 18 Instrument Panel Top Cover**

1 – SPEAKER

- (5) Lift rear edge and slide top cover rearward disengaging clips and remove cover.

**INSTALLATION**

For installation, reverse the above procedures. Ensure the two center clips are engaged first. Place thumb in VIN opening and pull towards pad to ensure VIN alignment. If a gap exist between the top cover and pad after installation check for a damaged clip. The clip must be removed and replaced.

**REMOVAL AND INSTALLATION (Continued)****LEFT UNDER INSTRUMENT PANEL SILENCER/ DUCT****REMOVAL**

(1) Remove two lower knee bolster screws and slip silencer off outboard attaching formation.

(2) Maneuver part off of center floor distribution duct to remove.

**INSTALLATION**

For installation, reverse the above procedures. Install prior to knee bolster.

**MASK/LENS****REMOVAL**

(1) Remove Cluster Hood. Refer to Cluster Hood Removal and Installation in this section.

Remove mask/lens retaining screws and remove mask/lens (Fig. 13).

**INSTALLATION**

For installation, reverse the above procedures.

**ODOMETER/TRANSMISSION RANGE INDICATOR**

The Instrument Cluster must be removed to service the Odometer/Transmission Range Indicator. Refer to Instrument Cluster Removal and Installation in this section.

**REMOVAL**

(1) Remove Speedometer/Tachometer, Refer to Speedometer/Tachometer and Odometer/Transmission Range Indicator Removal and Installation in this section.

(2) Remove screws attaching from the back of speedometer and remove the odometer/transmission range indicator display (Fig. 19).

**INSTALLATION**

For installation, reverse the above procedures.

**RADIO**

For Radio Removal and Installation, Refer to Group 8F, Audio Systems.

**RIGHT UNDER INSTRUMENT PANEL SILENCER/DUCT****REMOVAL**

(1) Remove two push-in fasteners under right end of instrument panel.

(2) Maneuver part off center floor distribution duct to remove.

**INSTALLATION**

For installation, reverse the above procedures.

**SPEEDOMETER, TACHOMETER, ODOMETER, AND TRANSMISSION RANGE INDICATOR**

The Instrument Cluster must be removed to service the speedometer-tachometer-odometer and transmission range indicator. Refer to Instrument Cluster Removal and Installation in this section.

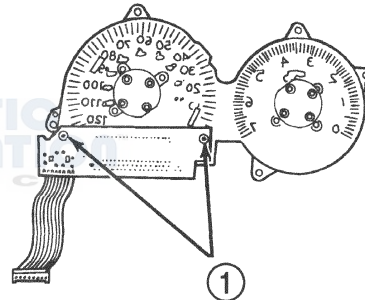
**REMOVAL**

(1) Remove mask/lens retaining screws and remove mask/lens (Fig. 13).

(2) Disconnect odometer / transmission range indicator connector from the printed circuit board (Fig. 14).

(3) Remove screws attaching speedometer / tachometer to housing and remove (Fig. 15).

(4) Remove screws attaching from the back of speedometer and remove the odometer / transmission range indicator display (Fig. 19).



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**Fig. 19 Odometer/Transmission Range Indicator**

1 - MOUNTING SCREWS

**INSTALLATION**

For installation, reverse the above procedures.

**TRACTION CONTROL SWITCH**

The Traction Control Switch is located within the instrument cluster hood, just to the right of the steering column (Fig. 20).

**REMOVAL**

(1) Disconnect and isolate the battery negative remote cable (Fig. 11).

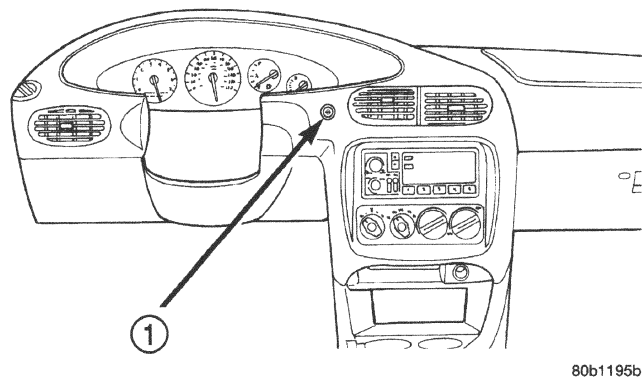
(2) Using a trim stick (special tool #C-4755) or suitable tool, gently pry out on traction control switch and remove it from instrument cluster hood.

(3) Disconnect harness connector from Traction Control Switch.

**INSTALLATION**

For installation, reverse the above procedures.



**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 20 Traction Control Switch Location**

1 - TRACTION CONTROL SWITCH

Instrument Cluster Removal and Installation in this section.

**REMOVAL**

(1) Disconnect Vehicle Theft / Security System LED socket assembly from the printed circuit board (Fig. 9).

(2) Rotate LED socket counter clockwise and remove from printed circuit board.

**INSTALLATION**

For installation, reverse the above procedures.

**VEHICLE THEFT/SECURITY SYSTEM LED**

The Instrument Cluster must be removed to service the Vehicle Theft/Security System LED. Refer to



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PRODUCT**

# AUDIO SYSTEMS

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## DESCRIPTION AND OPERATION

### AUDIO SYSTEM

#### DESCRIPTION

Several combinations of radio receivers and speaker systems are offered as optional equipment. The audio system uses an ignition switched source of battery current so that the system will only operate when the ignition switch is in the ON or Accessory positions.

The audio system includes the following components:

- Antenna
- Power amplifier (with premium speaker system only)
- Radio noise suppression components
- Radio receiver
- Speakers

The vehicle has two speaker systems:

#### STANDARD SPEAKER SYSTEM

- Two instrument panel speakers
- Two door speakers
- Two rear quarter panel speakers

#### INFINITY AMPLIFIED SPEAKER SYSTEM

- Amplifier mounted under the passenger seat
- Two instrument panel speakers
- Two door speakers
- Two rear quarter panel speakers

#### OPERATION

See the owner's manual in the vehicle glove box for more information on the features, use and operation of each of the available audio systems.

## INTERFERENCE ELIMINATION

### DESCRIPTION

Some components used on the vehicles are equipped with a capacitor to suppress radio frequency interference/static.

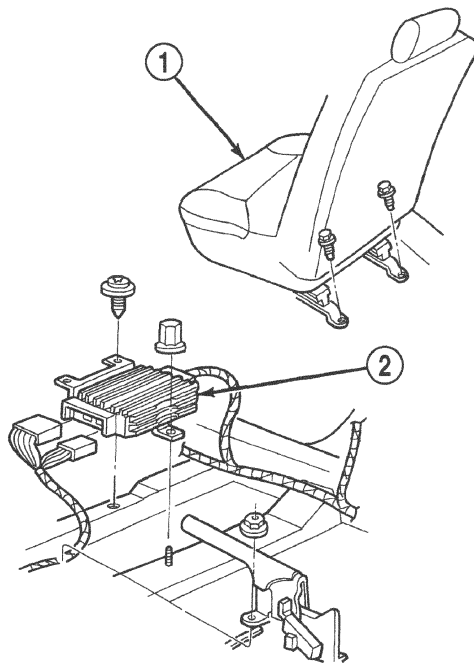
### OPERATION

Capacitors are mounted in various locations internal to the alternator, instrument cluster and windshield wiper motor.

To eliminate radio interference, ground straps are used in different areas of the vehicle. These ground circuits should be securely tightened to assure good metal to metal contact. The ground straps conduct very small high frequency electrical signals to ground and require clean surface contact area. The radio ground wire is supplied from the instrument panel harness and is attached to the rear of the radio. Some engines have other ground straps to eliminate further radio interference:

- Engine to shock tower, 2.0L - 2.4L - 2.5L engines
- Engine to transmission, 2.5L engine
- Muffler to bumper beam, 2.0L - 2.4L engines

Radio resistance type spark plug cables in the high tension circuit of the ignition system complete the interference suppression. Faulty or deteriorated spark plug wires should be replaced.

**DESCRIPTION AND OPERATION (Continued)****REMOTE AMPLIFIER****DESCRIPTION****Fig. 1 Remote Amplifier Location**

- 1 - PASSENGER SEAT  
2 - AMPLIFIER

The amplifier is located under the right front seat.

**OPERATION**

When the radio system is ON, and all or some speakers are not operating or have a noise distortion refer to the diagnostic tests. Refer to Group 8W, Wiring Diagrams for Pin numbers and location.

The amplifier provides unique sound equalizations when the convertible top is in the up position or in the down position. The amplifier remembers which mode it is in as long as the battery voltage (B+) is supplied to the amplifier. If the battery voltage is removed for only a few minutes by:

- Disconnecting the battery
- Dead battery
- Fuse Removal
- Amplifier disconnected

The amplifier reverts to a top up condition even if the top is down. If the amplifier mode does not match the convertible top position, operate the convertible top one cycle and this will reset amplifier to the correct mode.

**REMOTE CD CHANGER****DESCRIPTION**

The remote CD changer is located in the center console and is capable of holding up to six discs in a magazine.

**OPERATION**

The magazine can be ejected at anytime that the ignition switch is in the ON position. After the ignition switch is turned OFF, the magazine can only be ejected within one minute. After that period, the magazine will be locked in the CD changer.

**DIAGNOSIS AND TESTING****AUDIO DIAGNOSTIC TEST PROCEDURES**

**CAUTION:** The CD changer/player is designed to operate between approximate temperatures of -23°C and +65°C (-10°F and +145°F).

Whenever a radio malfunction occurs;

(1) First check FUSES in the Junction Block:

- (a) Fuse 5, Memory feed - Power Amplifier (if equipped)
- (b) Fuse 7, Illumination
- (c) Fuse 14, Ignition feed

**NOTE:** The vehicles are shipped with the INTERIOR LAMP fuse disconnected.

(2) Verify, the radio wire harness are properly connected before starting normal diagnosis and repair procedures. Refer to Audio Diagnostic Charts and/or Group 8W, Wiring Diagrams.

**DIAGNOSTIC CONDITIONS****NOISE DISTORTION IN ALL SPEAKERS**

Does the distortion occur through all operations:

- AM and FM stations
- Cassette tape
- Compact disc

If not, check for radio interference, damaged tape or disc that may be causing the distortion. Refer to Sound Systems Operating Instructions in the Owners Manual for cleaning procedures of the cassette tape player.

- Check battery voltage, for 11 Volts or more
- Check amplifier connector for proper connection
- If OK, check radio, refer to Radio Diagnosis
- If OK, check circuit between the radio and the amplifier. If OK, check between the amplifier and the speakers.
- If OK, replace amplifier

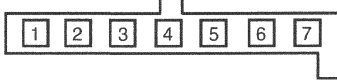


## DIAGNOSIS AND TESTING (Continued)

## RADIO CONNECTORS

## STANDARD SYSTEM

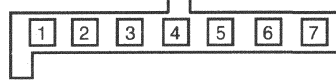
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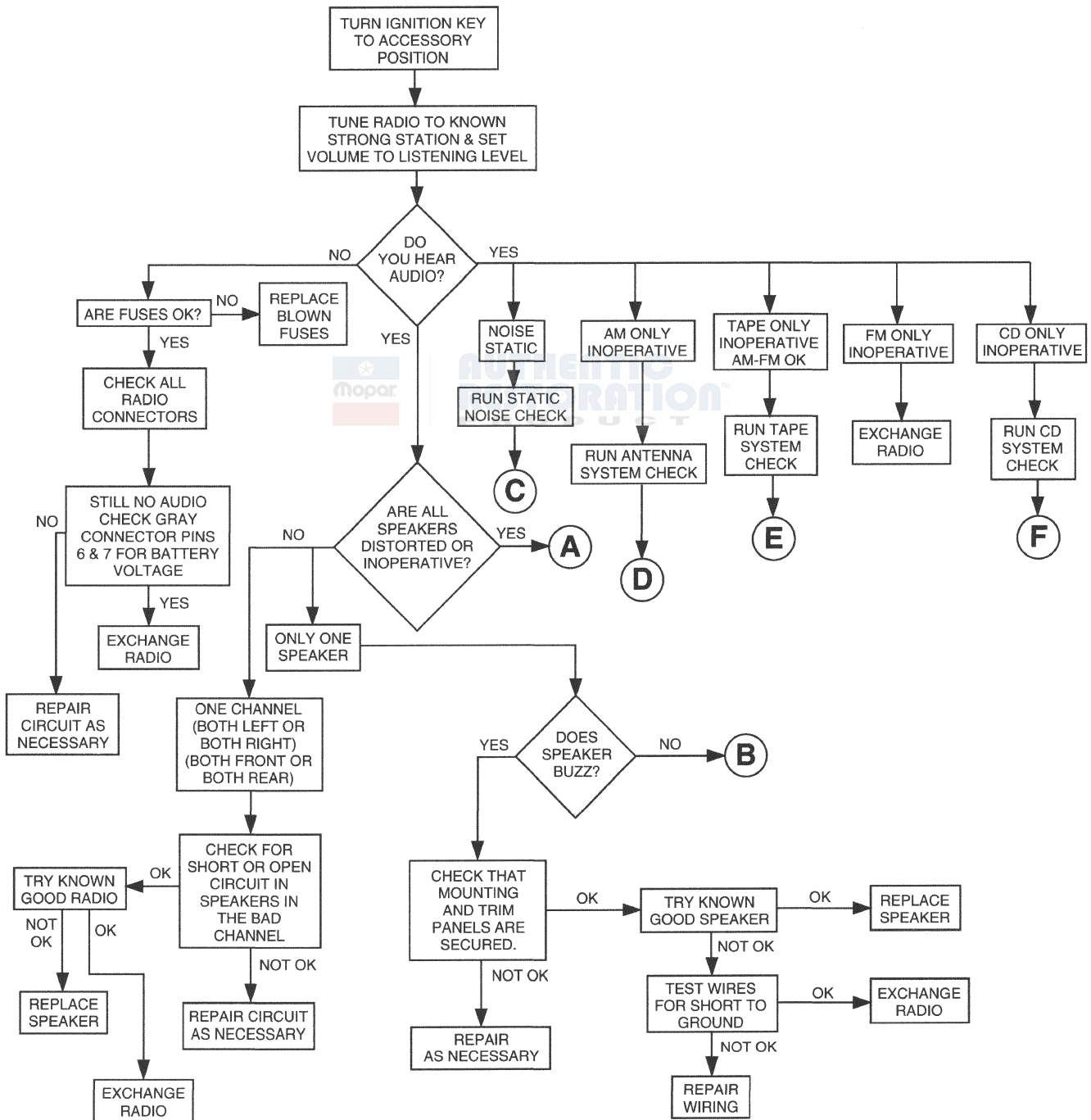
## LEGEND:

- 1 - AMP ON-OFF SIGNAL/ANT UP SIGNAL
- 2 - LEFT REAR SPEAKER FEED (+)
- 3 - RIGHT REAR SPEAKER FEED (+)
- 4 - LEFT FRONT SPEAKER FEED (+)
- 5 - RIGHT FRONT SPEAKER FEED (+)
- 6 - LEFT REAR SPEAKER RETURN (-)
- 7 - RIGHT REAR SPEAKER RETURN (-)

## GRAY

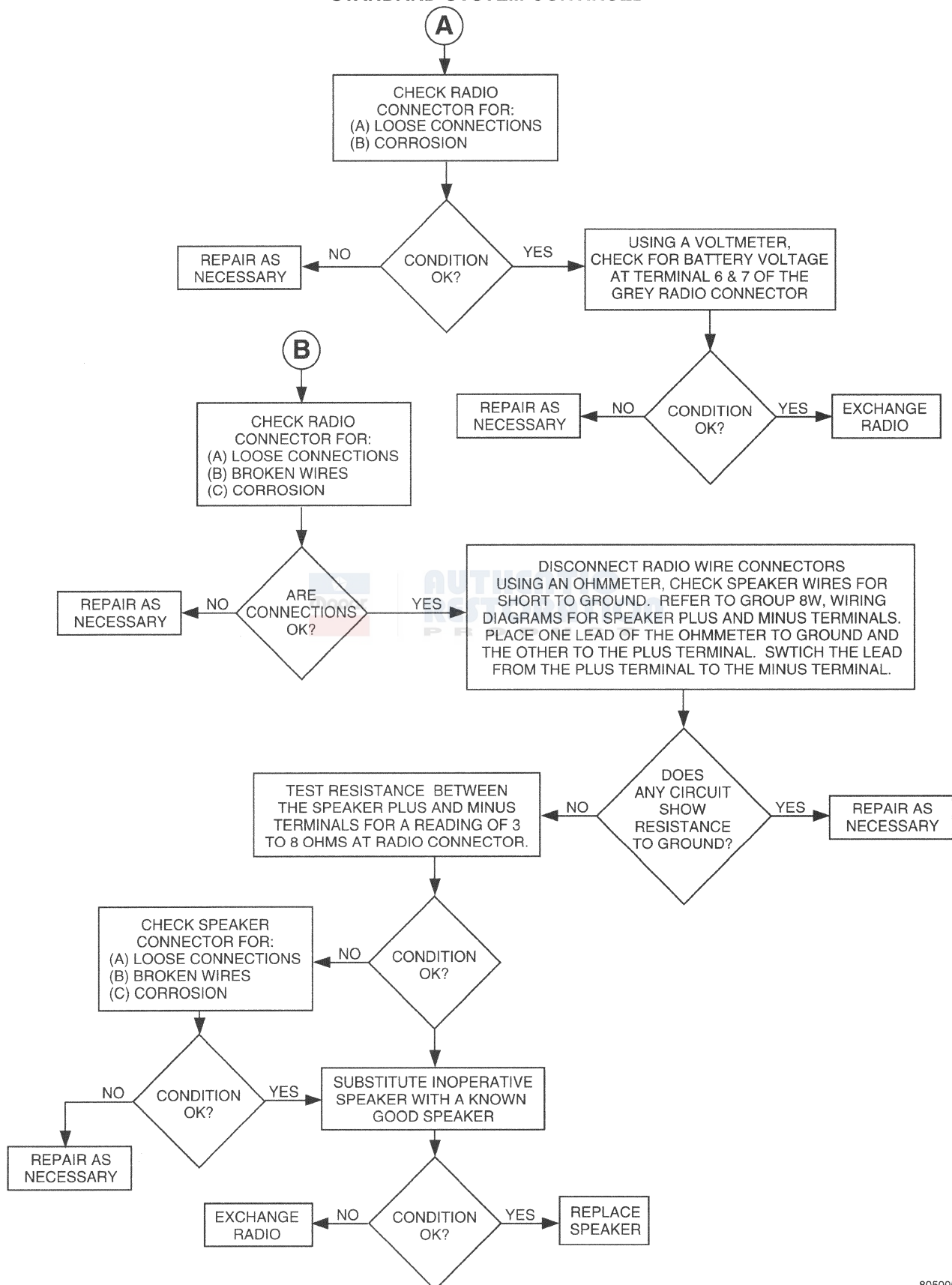
VIEW FROM  
WIRE END

- 1 - RADIO MUTE
- 2 - LEFT FRONT SPEAKER RETURN (-)
- 3 - RIGHT FRONT SPEAKER RETURN (-)
- 4 - MARKER -- (HEAD/PARK LAMPS)
- 5 - DIMMER -- (PANEL, LAMPS, VARIABLE)
- 6 - ACCESSORY -- (SWITCHED B+)
- 7 - BATTERY -- (MEMORY)



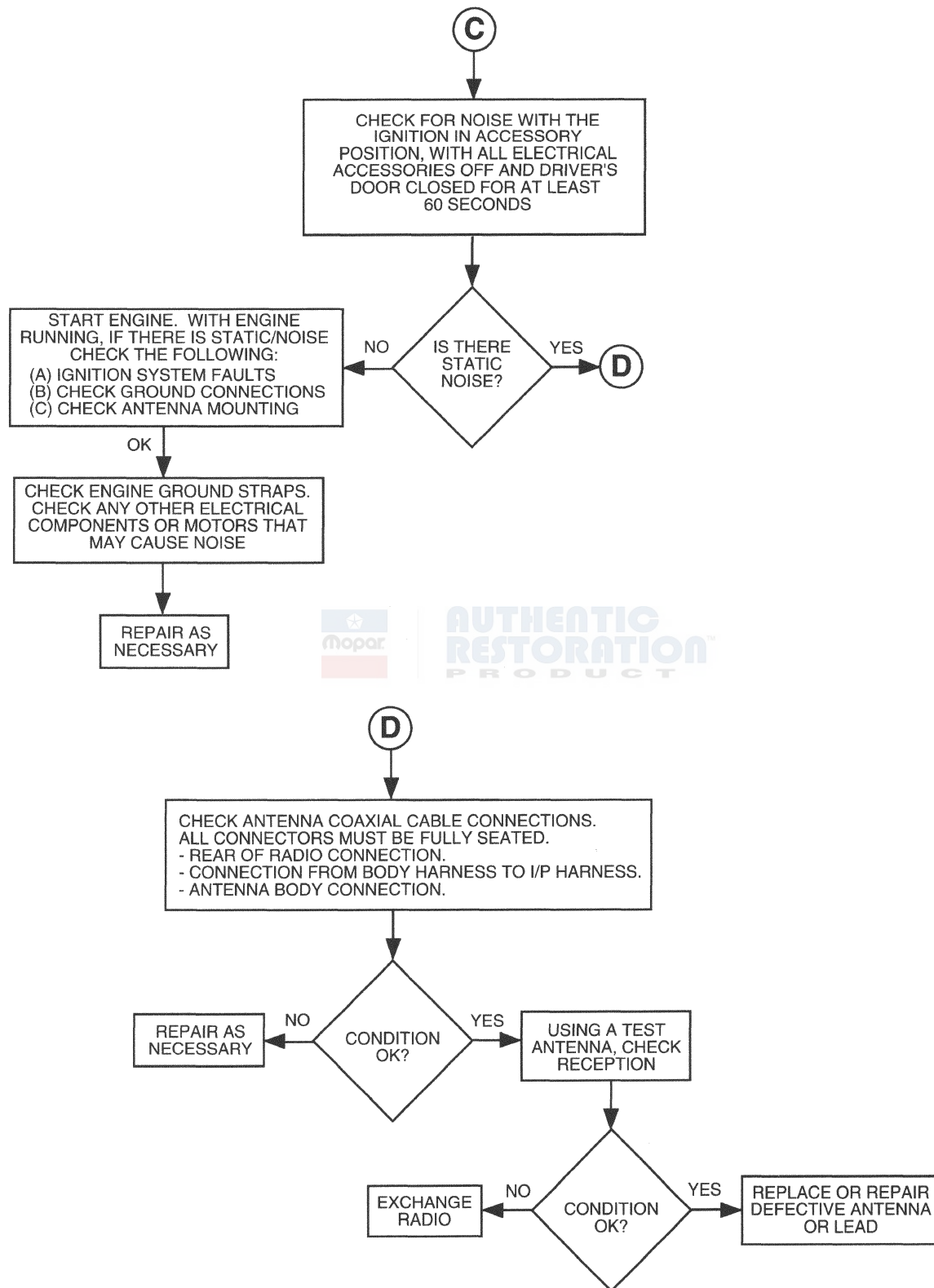
## DIAGNOSIS AND TESTING (Continued)

## STANDARD SYSTEM CONTINUED



## DIAGNOSIS AND TESTING (Continued)

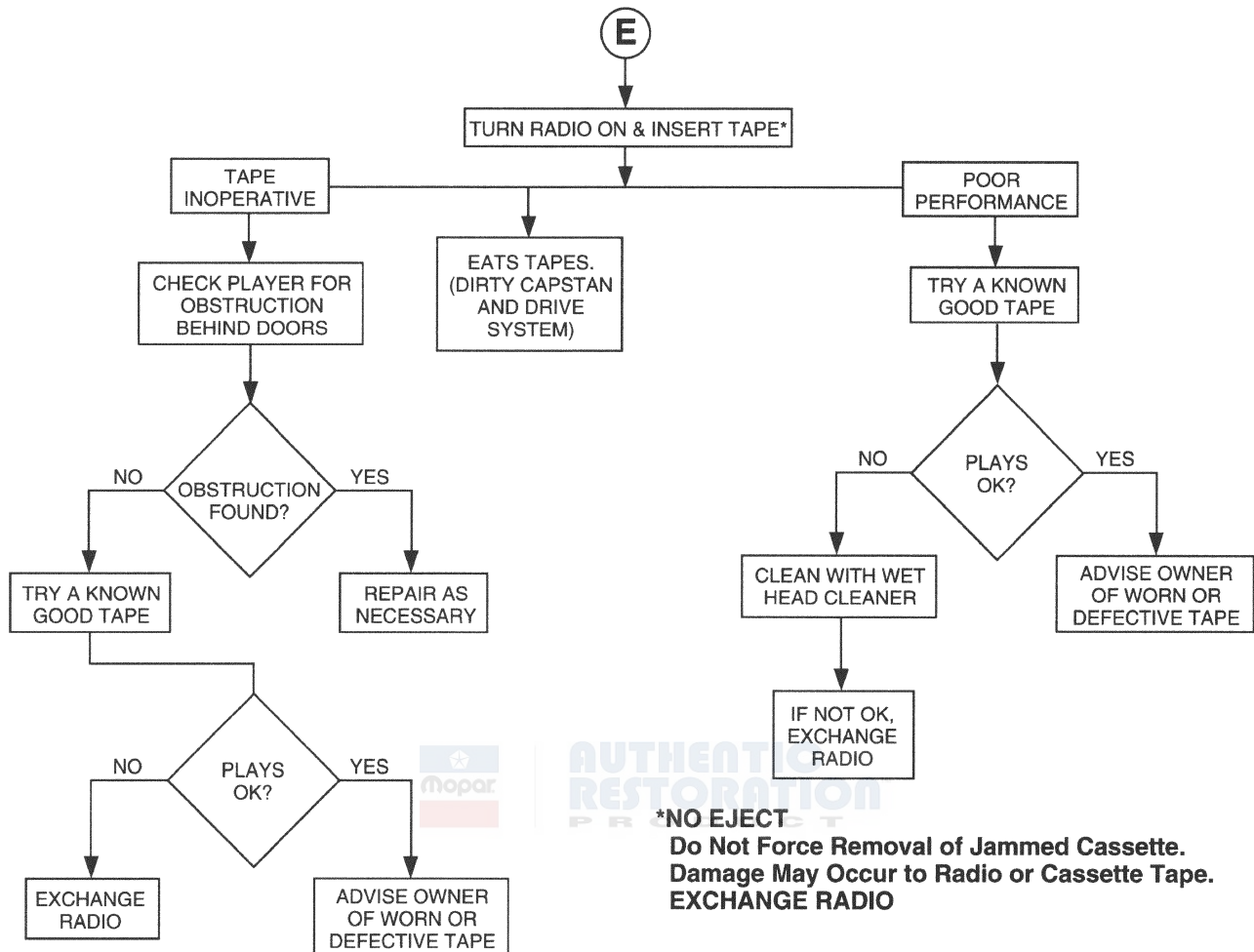
## STANDARD SYSTEM CONTINUED





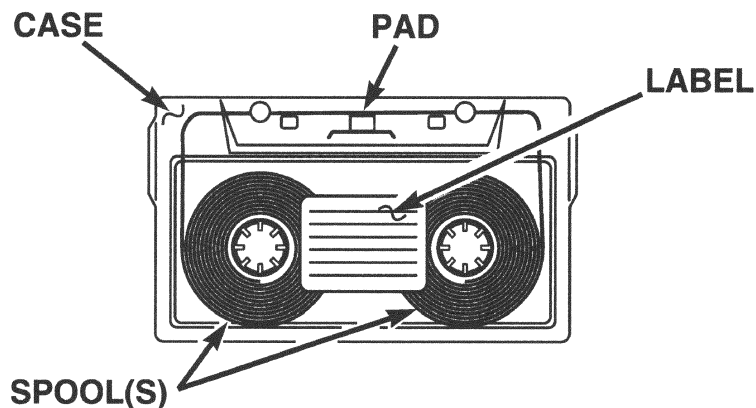
## DIAGNOSIS AND TESTING (Continued)

## STANDARD SYSTEM CONTINUED



## CHECK TAPES FOR:

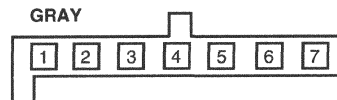
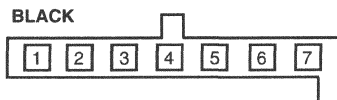
- CRACKED OR WARPED CASE
- LOOSE LABEL ON CASE
- TAPE PAD MISSING
- TAPE SPOOL(S) JAMMING
- TWISTED OR WRINKLED TAPE



## DIAGNOSIS AND TESTING (Continued)

## INFINITY AMPLIFIED SYSTEM

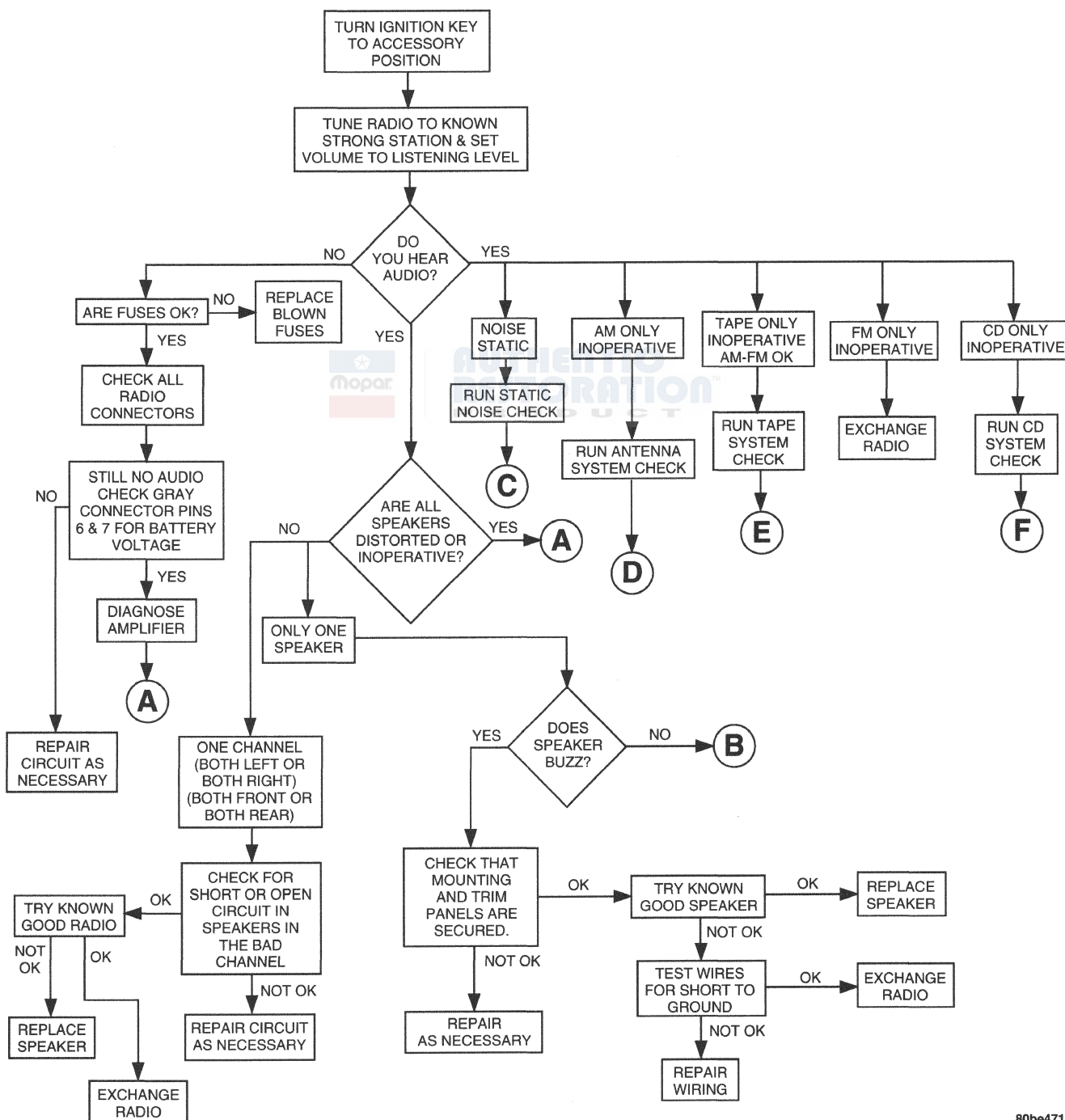
## RADIO CONNECTORS

VIEW FROM  
WIRE END

## LEGEND:

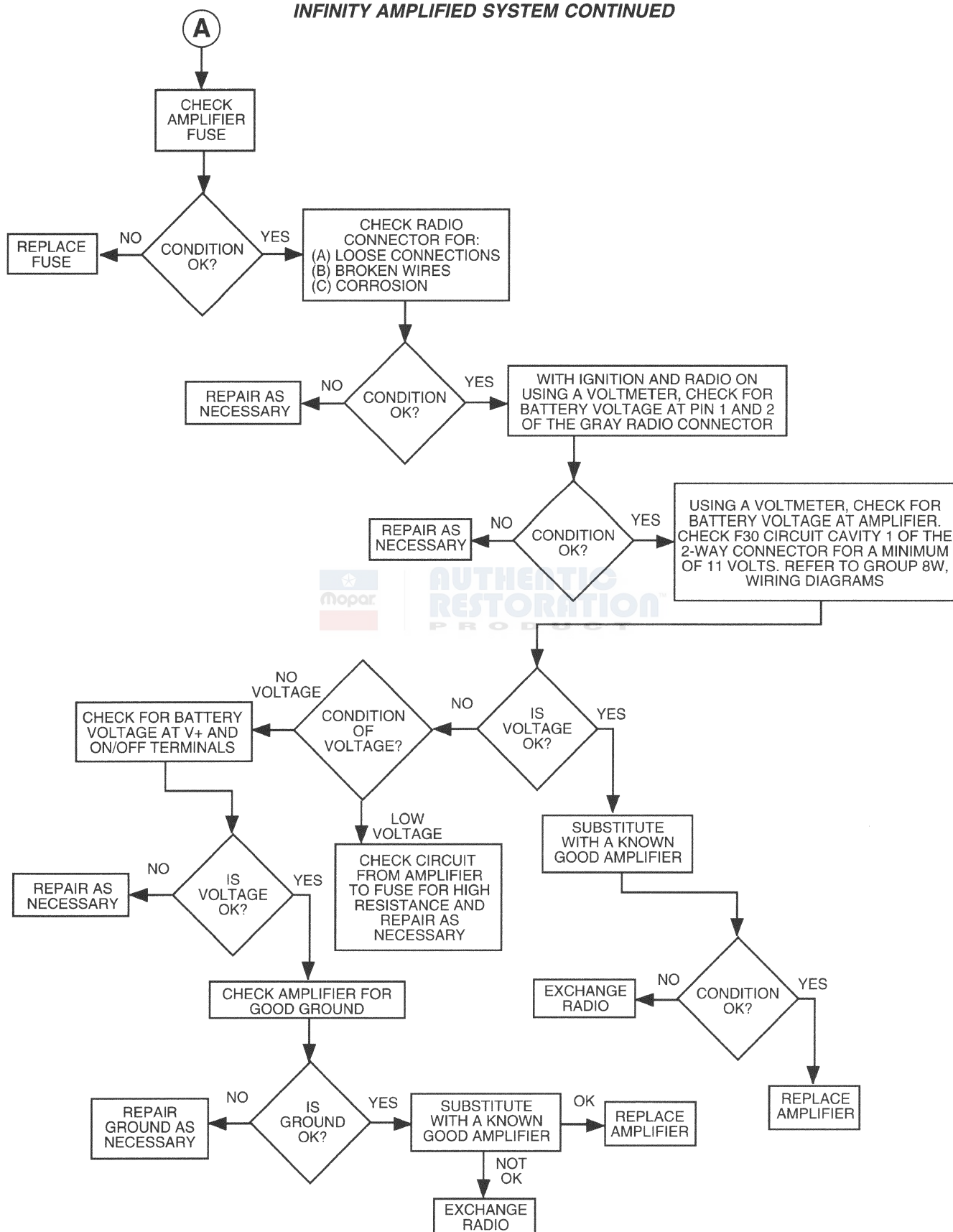
- 1 - AMP ON-OFF SIGNAL/ANT UP SIGNAL
- 2 - LEFT REAR SPEAKER FEED (+)
- 3 - RIGHT REAR SPEAKER FEED (+)
- 4 - LEFT FRONT SPEAKER FEED (+)
- 5 - RIGHT FRONT SPEAKER FEED (+)
- 6 - LEFT REAR SPEAKER RETURN (-)
- 7 - RIGHT REAR SPEAKER RETURN (-)

- 1 - RADIO MUTE
- 2 - LEFT FRONT SPEAKER RETURN (-)
- 3 - RIGHT FRONT SPEAKER RETURN (-)
- 4 - MARKER -- (HEAD/PARK LAMPS)
- 5 - DIMMER -- (PANEL, LAMPS, VARIABLE)
- 6 - ACCESSORY -- (SWITCHED B+)
- 7 - BATTERY -- (MEMORY)



## DIAGNOSIS AND TESTING (Continued)

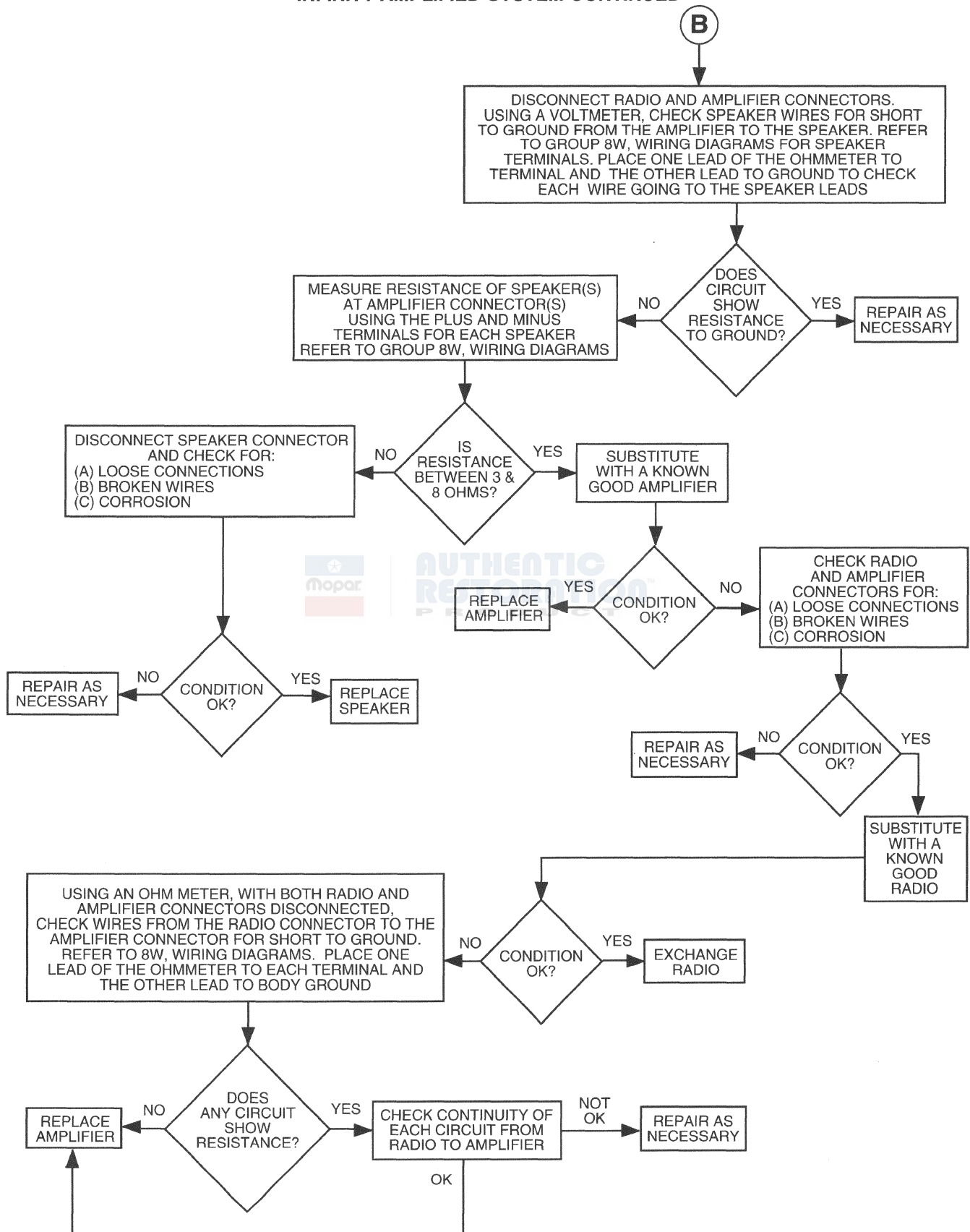
## INFINITY AMPLIFIED SYSTEM CONTINUED





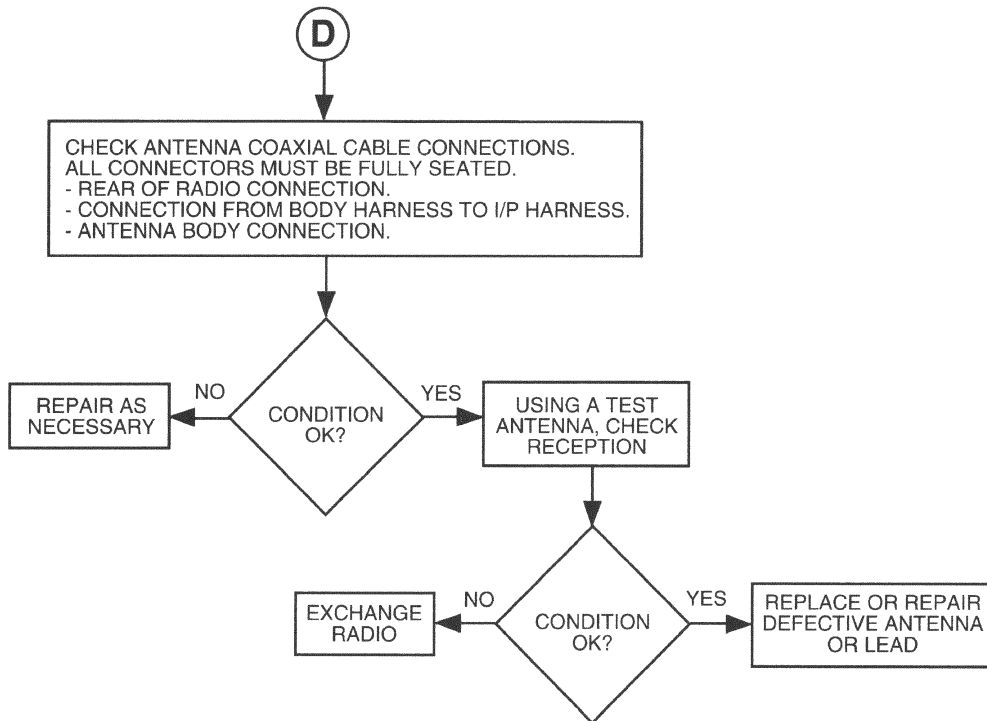
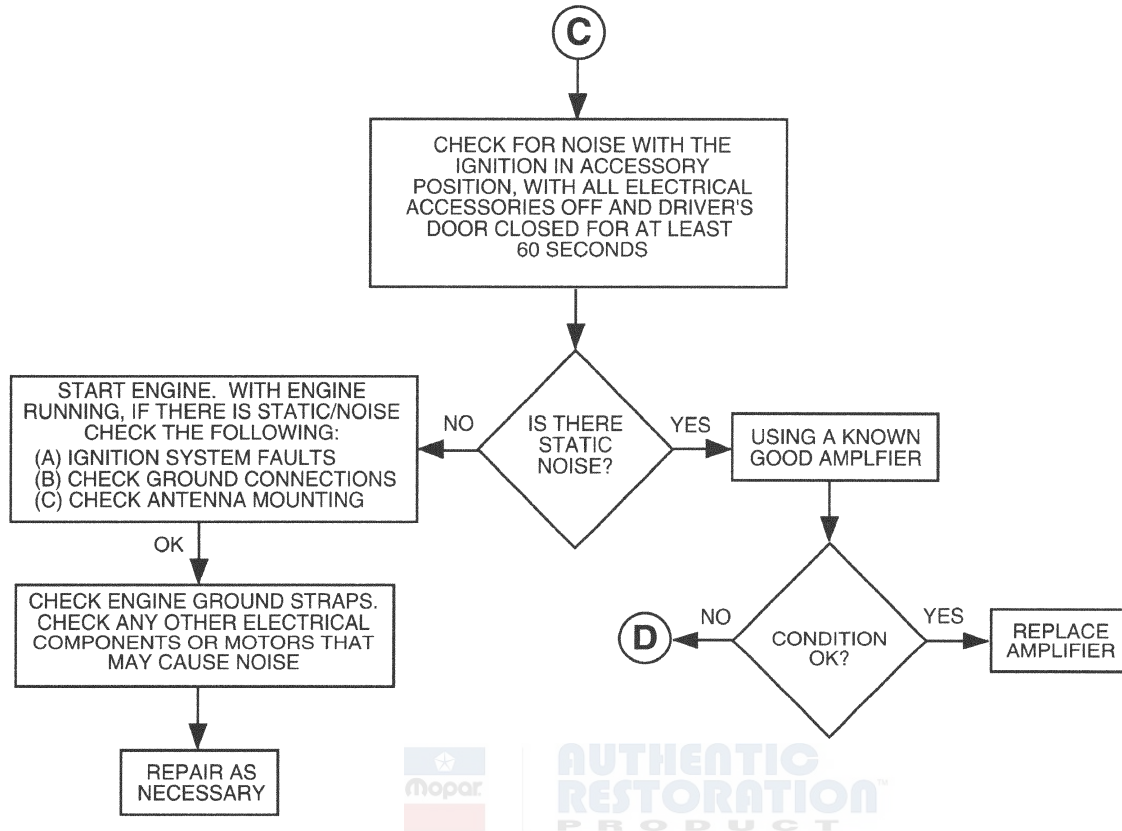
## DIAGNOSIS AND TESTING (Continued)

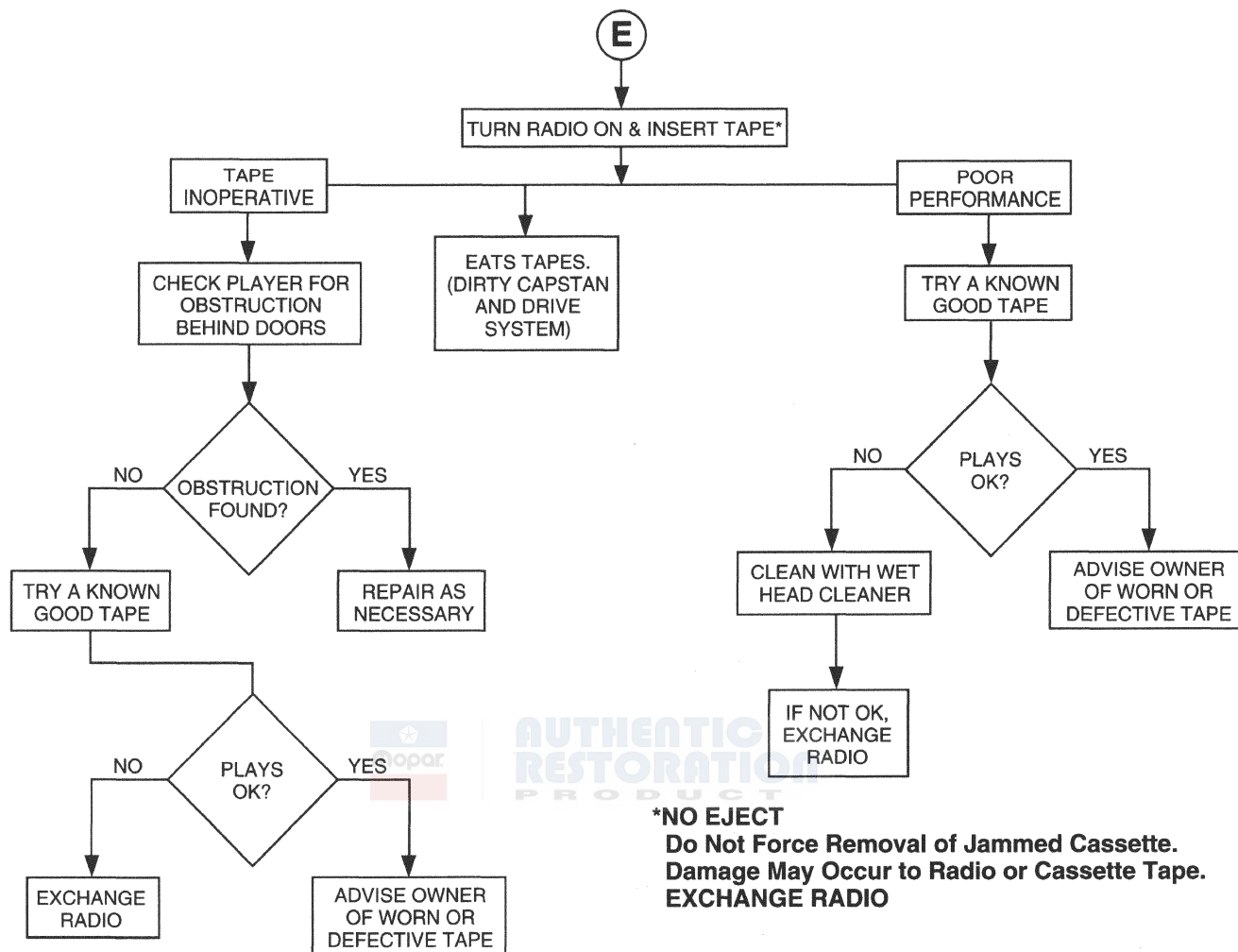
## INFINITY AMPLIFIED SYSTEM CONTINUED



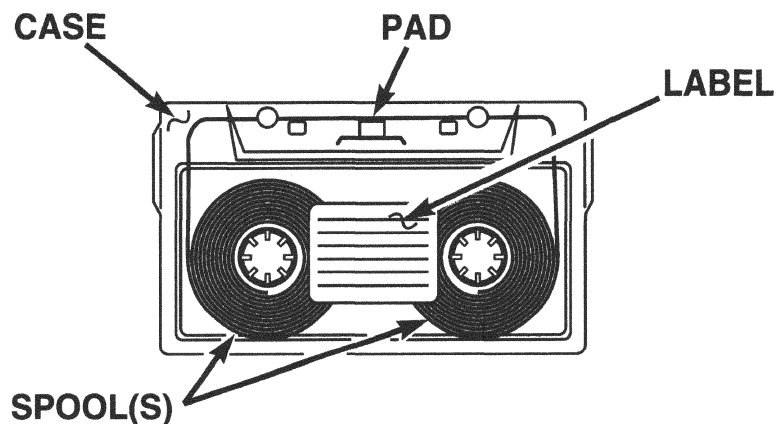
## DIAGNOSIS AND TESTING (Continued)

## INFINITY AMPLIFIED SYSTEM CONTINUED



**DIAGNOSIS AND TESTING (Continued)****INFINITY AMPLIFIED SYSTEM CONTINUED****CHECK TAPES FOR:**

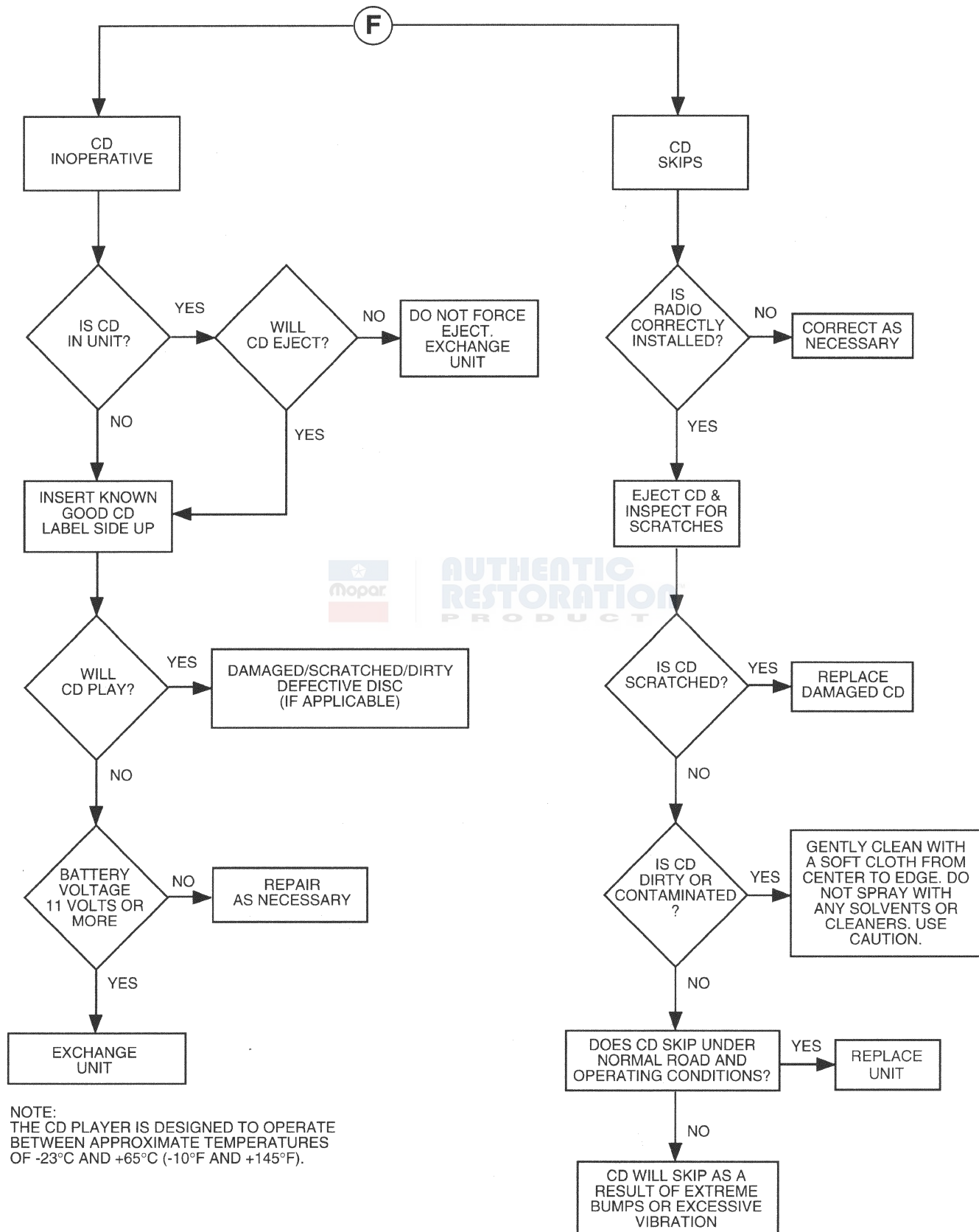
- CRACKED OR WARPED CASE
- LOOSE LABEL ON CASE
- TAPE PAD MISSING
- TAPE SPOOL(S) JAMMING
- TWISTED OR WRINKLED TAPE





## DIAGNOSIS AND TESTING (Continued)

## INFINITY AMPLIFIED SYSTEM CONTINUED



## DIAGNOSIS AND TESTING (Continued)

### ELECTRICAL NOISE DISTORTION ONE SPEAKER

- Remove output signal connector from (\*) amplifier and check for short to ground on the speaker with the distortion. Refer to Group 8W, Wiring Diagrams for the appropriate pin numbers.
- If shorted to ground, disconnect speaker connector and recheck from the (\*) amplifier for short to ground.
- If still shorted to ground, repair wires. Not shorted to ground, replace speaker.
- Not shorted to ground, check speaker resistance at (\*) amplifier connector for two to five ohms.
- If resistance is OK, refer to Radio Diagnosis. If radio checks OK, replace amplifier.
- If resistance is less than two ohms, replace speaker. If resistance is OK, repair wires

**NOTE:** (\*) From radio if standard system.

### MECHANICAL NOISE DISTORTION

- Check trim for loose parts, and speaker attachments for buzzes, repair as necessary.
- Remove speaker while still connected and listen for distortion. If distortion remains, replace speaker.

### ONE SPEAKER NON-OPERATIVE

- Remove connector from (\*) amplifier and check for two to five ohms resistance to the non-operative speaker. Refer to Group 8W, Wiring Diagrams for the appropriate pin numbers.
- If resistance is less than two ohms, test speaker for resistance.
- If OK, refer to Audio Diagnostic Test Procedures. If not OK, replace speaker.

**NOTE:** (\*) From radio if standard system.

### ALL SPEAKERS NON-OPERATIVE

- Check radio for ON state, are the display lights on
  - Radio not ON, refer to Radio Diagnosis
  - Check fuses, amplifier connectors and wires for proper connection
  - Check for good ground
  - Check amplifier (if equipped with premium system), for battery voltage and ON/OFF voltage
- (1) Battery voltage OK and NO voltage at the ON/OFF terminal, check for short or open in the ON/OFF circuit.
  - (2) ON/OFF voltage OK, and NO battery voltage, check for short or open in battery circuit.
  - (3) Prior to replacing amplifier check fuse 5 in the Junction Block. If not OK, replace fuse. If fuse blows again disconnect amplifier B+ wire connector. Refer

to Group 8W, Wiring Diagrams for the proper connector.

(4) If fuse still blows the problem is not the amplifier. If fuse does not blow replace the amplifier.

(5) If shorted or open circuit repair as necessary.

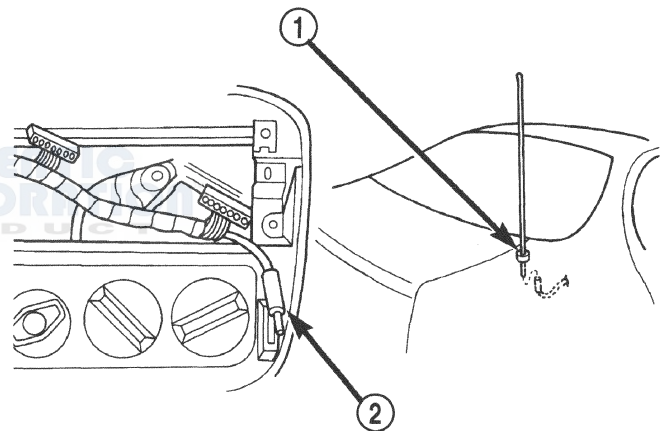
### MANUAL ANTENNA

Check for short or open circuits with an ohmmeter once the antenna cable is disconnected from the radio. The radio coax cable has a connector that connects behind the between passenger seat and console.

(1) Continuity (less than 1 ohm) should be present between the antenna mast and radio end pin of antenna cable plug (Fig. 2).

(2) No continuity should be observed or a very high resistance of several megohms between the ground shell of the connector and radio end pin.

(3) Continuity should be observed between the ground shell of the connector and the mounting hardware in the trunk right rear quarter panel



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**Fig. 2 Antenna Test Points**

1 - BASE TEST POINT

2 - RADIO TEST POINT

### REMOTE CD CHANGER

CD changer inoperative.

(1) The CD changer receives its power and ground through the radio via the DIN connector. Verify that the radio powers up and functions before proceeding.

(2) With the radio turned ON, check the radio display when pushing the MODE/EJECT button to select the CD mode.

(a) If the display shows “- - -”, then insert a CD magazine in the changer.

(b) If the display shows “nocd”, then insert a CD into the magazine.

(c) If the display shows Err “xxxx”, then check the error message table below.

**DIAGNOSIS AND TESTING (Continued)**

(d) If the radio only switches between AM and FM turning modes, then perform the following:

(I) Check the connection of the DIN cable to the CD changer and radio.

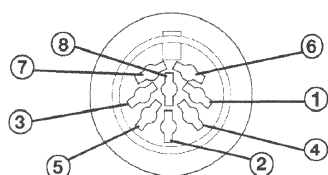
(II) If OK, then check the DIN cable at the CD changer side.

(III) Make sure the DIN cable is connected to the radio and radio is turned ON and operating. Check for battery voltage at Pins 6 and 7 using Pin 8 for ground.

(IV) If OK, then replace CD changer.

(V) If not OK, then remove DIN cable from radio and changer. Check DIN cable for continuity from connector to connector, using a ohmmeter on each Pin. If not OK, replace DIN cable.

(VI) If the DIN cable OK, then replace the radio.



**DIN Cable Connector**

**DIN CABLE PIN-OUTS**

PIN 1	DATA BUS (-)	PIN 5	AUDIO IN (L)
PIN 2	AUDIO GRD	PIN 6	BATTERY
PIN 3	DATA BUS (+)	PIN 7	IGNITION
PIN 4	AUDIO IN (R)	PIN 8	GROUND

**ERROR MESSAGES**

DISPLAY	EXPLANATION	WHAT TO DO
NOCD	NO DISC OR DISCS IN MAGAZINE	LOAD DISCS IN MAGAZINE
- - - -	NO MAGAZINE IN PLAYER	LOAD MAGAZINE IN PLAYER
ERR HOT	PLAYER OVERHEATING	ALLOW TO COOL DOWN
ERR EE EE	COMMUNICATION PROBLEM	TURN IGNITION OFF TO RESET, CHECK CABLE CONNECTION. IF OK, REPLACE CHANGER.
ERR E-01	DEADLOCK PROBLEM	REPLACE CHANGER.
ERR E-02	DISC EJECT PROBLEM	REPLACE CHANGER.
ERR E-06	ELEVATOR PROBLEM	REPLACE CHANGER.
ERR E-07	MAGAZINE EJECT PROBLEM	CHECK THAT THE MAGAZINE IS OK. IF OK, REPLACE CHANGER.
ERR PLAY	DISCS CANNOT PLAY	CHECK DISC LOADING, OR TRY ANOTHER DISC. IF OK, REPLACE CHANGER.

**REMOVAL AND INSTALLATION****DOOR MOUNTED SPEAKER**

**CAUTION:** Do not operate the radio with speaker leads detached. Damage to the output devices may result.

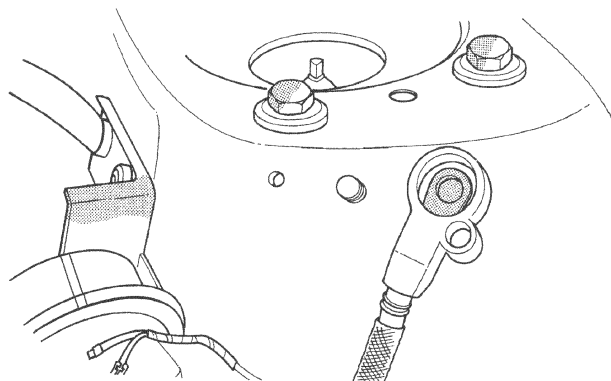
**REMOVAL**

(1) Disconnect and isolate the battery negative remote cable (Fig. 3).

(2) Carefully, pry speaker grille away from door trim panel (Fig. 4).

(3) Remove four speaker retaining screws.

(4) Pull speaker away from door and disconnect wiring.



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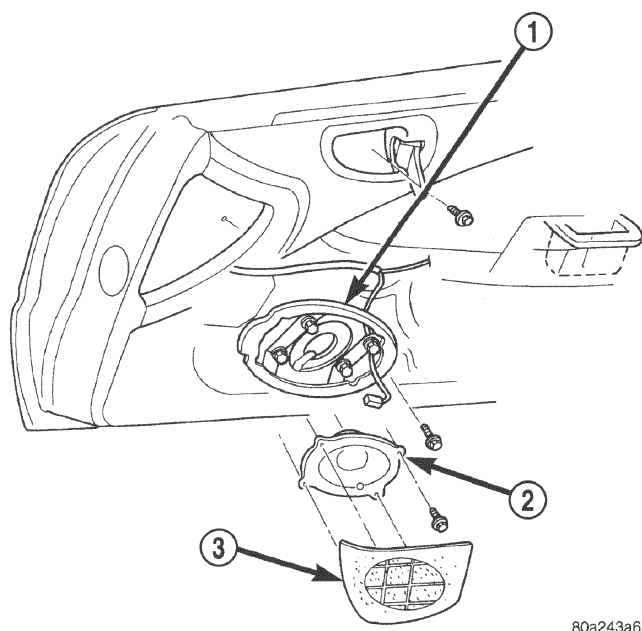
**Fig. 3 Battery Negative Remote Cable Removal**

**INSTALLATION**

For installation reverse above procedures. Ensure speaker is in the proper position and screws are tight.



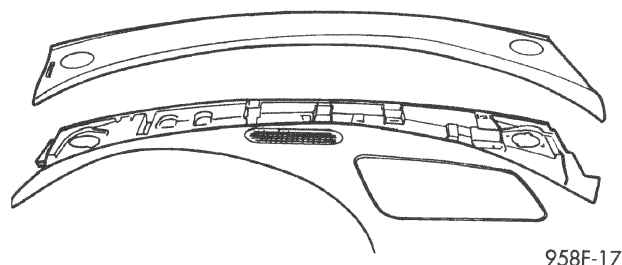
## REMOVAL AND INSTALLATION (Continued)



**Fig. 4 Door Mounted Speaker**

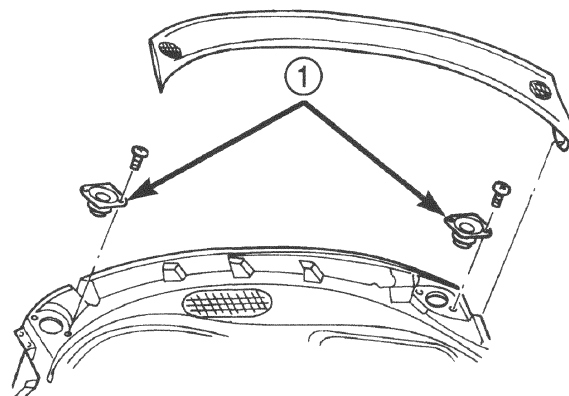
- 1 - FRONT DOOR SPEAKER BRACKET
- 2 - SPEAKER
- 3 - GRILLE

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**Fig. 5 Instrument Panel Top Cover**



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**Fig. 6 Instrument Panel Speakers**

- 1 - SPEAKER

## INSTRUMENT PANEL SPEAKER

**CAUTION:** Do not operate the radio with speaker leads detached. Damage to the output devices may result.

### REMOVAL

- (1) Disconnect and isolate the battery negative remote cable.
- (2) Using a trim stick (special tool #C-4755) or suitable tool, gently pry out and remove both left and right A-pillar trim moldings.
- (3) Remove instrument panel top cover:
  - (a) Remove screw from right side of the top cover.
  - (b) Carefully, pry up each end of top cover to disengage clips (Fig. 5).
  - (c) Lift rear edge of top cover using a trim stick along rear edge.
  - (d) While lifting rear edge slide top cover rearward to disengage front clips and remove the top cover.
- (4) To remove speaker, remove two retaining screws. Lift up speaker and disconnect wire connector (Fig. 6).

### INSTALLATION

For installation, reverse the above procedures.

## MANUAL ANTENNA AND MAST

### REMOVAL

- (1) Inside trunk, pull the right side trunk liner aside.
- (2) Unplug antenna lead from base of antenna body.
- (3) Remove antenna mast by unscrewing mast from antenna body. Use tape (electrical) to prevent scratching of the mast base.
- (4) Remove cap nut and adapter (Fig. 7).
- (5) Pull antenna body down through the quarter panel and remove.

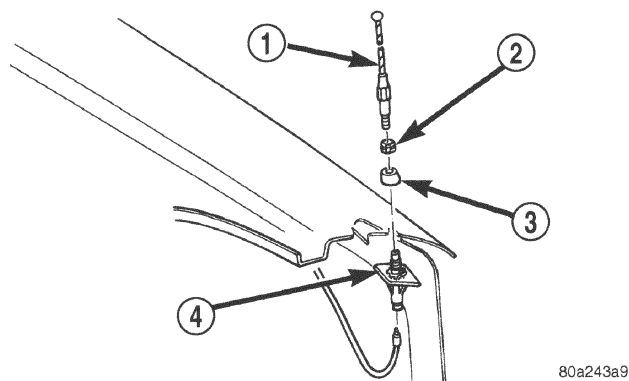
### INSTALLATION

For installation, reverse the above procedures. Check that the locating tab is in-line with the slot in the body before installing antenna. Tighten cap nut to 7 N·m (65 in. lbs.).

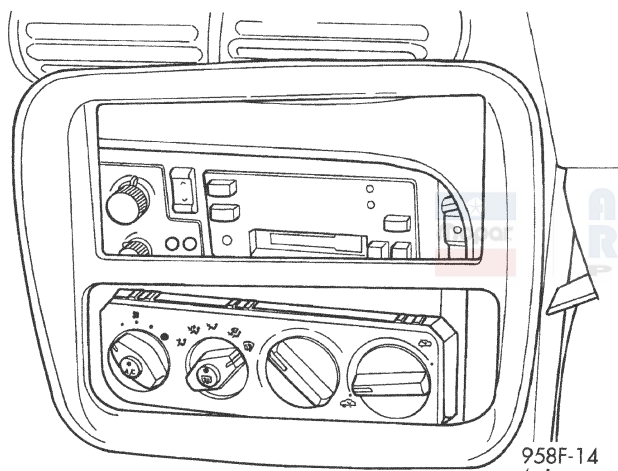
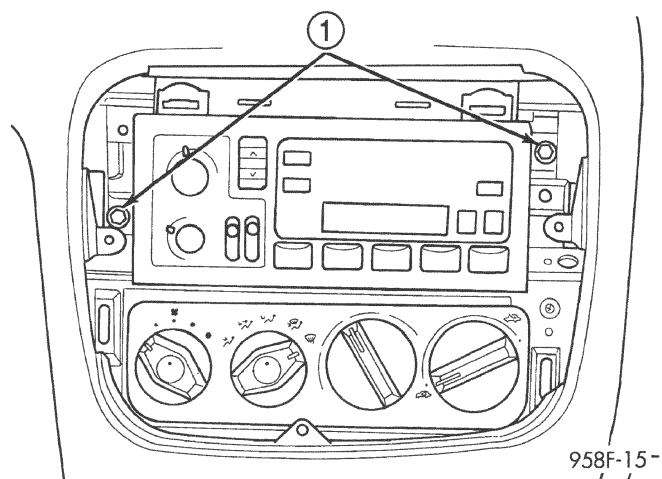
## RADIO

### REMOVAL

- (1) Disconnect and isolate the battery negative remote cable.
- (2) Remove center bezel by pulling straight back (Fig. 8).
- (3) Remove two radio mounting screws (Fig. 9).

**REMOVAL AND INSTALLATION (Continued)****Fig. 7 Antenna Mounting Removal**

- 1 - MANUAL MAST
- 2 - ANTENNA NUT
- 3 - ADAPTER
- 4 - ANTENNA BASE

**Fig. 8 Center Bezel Removal****Fig. 9 Radio Assembly**

- 1 - MOUNTING SCREWS

(4) Pull radio from panel and disconnect wire connectors and antenna lead from radio.

(5) Remove radio from vehicle.

**INSTALLATION**

For installation, reverse the above procedures.

**REAR QUARTER PANEL SPEAKER(S)**

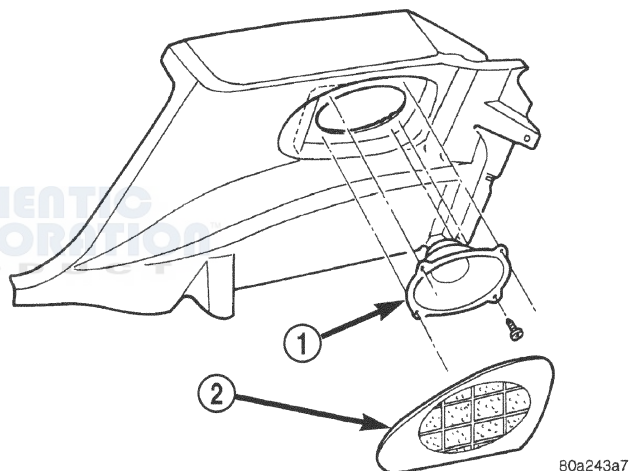
**CAUTION:** Do not operate the radio with speaker leads detached. Damage to the output devices may result.

**REMOVAL**

(1) Disconnect and isolate the battery negative remote cable (Fig. 3).

(2) Remove rear quarter panel speaker grille.

(3) Remove four retaining screws (Fig. 10).

**Fig. 10 Rear Speakers**

- 1 - SPEAKER
- 2 - GRILLE

(4) Disconnect wire connector and remove speaker.

**INSTALLATION**

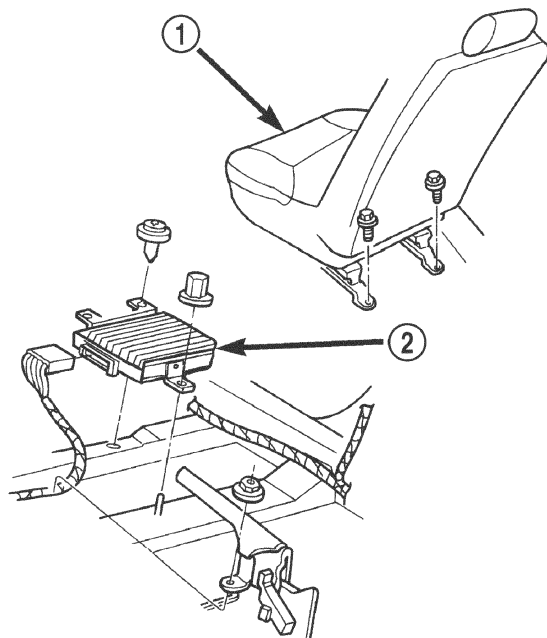
For installation reverse the above procedures. Be sure that the wire connectors are facing rearward in vehicle, and the screws are tightened.

**REMOTE AMPLIFIER****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable.

(2) Remove the right front seat. Refer to Group 23-Body, Manual Front Seat Removal and Installation.

(3) Remove the two front attaching screws and loosen the rear retaining nut (Fig. 11) to amplifier.

**REMOVAL AND INSTALLATION (Continued)****Fig. 11 Amplifier Location**

- 1 - PASSENGER SEAT  
2 - AMPLIFIER

(4) Disconnect the electrical connector and remove amplifier from vehicle.

**INSTALLATION**

- (1) For installation, reverse the above procedures.

(2) Tighten amplifier screws to 4 N·m (40 in. lbs.) torque.

(3) Push nut onto stud until seated.

(4) Reinstall front seat.

**REMOTE CD CHANGER AND MOUNTING BRACKET****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable.

(2) Remove the instrument cluster hood. Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.

(3) Remove the two CD changer attaching screws located under the HVAC control.

(4) Slide the CD changer/power outlet assembly rearward in the vehicle.

(5) Disconnect CD cable, cigar lighter / power outlet, and the light socket assembly wire connectors.

(6) Remove the CD changer and mounting bracket from vehicle.

**INSTALLATION**

For installation, reverse the above procedures.



# HORN SYSTEMS

## TABLE OF CONTENTS

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HORN RELAY .....	1	<b>REMOVAL AND INSTALLATION</b>	
<b>DIAGNOSIS AND TESTING</b>		HORNS .....	5
HORN .....	1	HORN CONTACT SWITCH .....	5
HORN CONTACT SWITCH .....	2	HORN RELAY .....	5
HORN RELAY .....	2		

## DESCRIPTION AND OPERATION

### HORN SYSTEM

**WARNING: ON VEHICLES EQUIPPED WITH AIR-BAG, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.**

#### DESCRIPTION

The horn circuit consists of a horn contact, horn relay, and horns.

#### OPERATION

The horn circuit feed is from the fuse to the horn relay in the Junction Block. When the horn contact is depressed, it completes the ground circuit. Then the horn relay coil closes a set of contacts which allows current to flow to the horns. The horn(s) are grounded at the shock tower. Refer to Group 8W, Wiring Diagrams for horn circuit.

### HORN RELAY

#### DESCRIPTION

The horn relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (or footprint) is different, current capacity is lower, and the relay case dimensions are smaller than on the conventional ISO relay.

#### OPERATION

The horn relay is a electromechanical device that switches current to the horn when the Driver Airbag Module is depressed. See the Diagnosis and Testing

section of this group for more information on the operation of the horn relay.

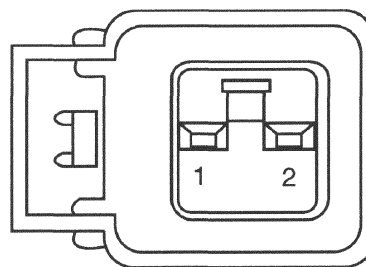
The horn relay is located in the Junction Block. Refer to the Junction Block label for horn relay identification and location.

If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the Junction Block until further diagnosis is completed. The horn relay cannot be repaired and, if faulty, it must be replaced.

## DIAGNOSIS AND TESTING

### HORN

- (1) Disconnect wire connector at horn.
- (2) Using a voltmeter, connect one lead to ground terminal and the other lead to the horn relay output wire terminal (Fig. 1).



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**Fig. 1 Horn Connector Pin Call - Out**

**DIAGNOSIS AND TESTING (Continued)****HORN CONNECTOR PIN CALL-OUT**

PIN #	CIRCUIT NAME
1	GROUND
2	HORN RELAY OUTPUT

(3) Depress the horn switch, battery voltage should be present.

(4) If no voltage, refer to Horn Does Not Sound. If voltage is OK, go to Step 5.

(5) Using ohmmeter, test ground wire for continuity to ground.

(6) If no ground repair as necessary.

(7) If wires test OK and horn does not sound, replace horn.

**HORN CONTACT SWITCH**

The horn contact consist of,

- A contact switch is mounted between the Driver Airbag Module and steering wheel
- The horn wire is attached to Driver Airbag Module mounting bracket.
- When the Driver Airbag Module is pressed the contact ring touches the bracket mounting bolts and makes contact to ground. The ground signal is carried to the horn relay and horn sounds.

(1) Ground horn wire (Fig. 2).

(2) If horn does not sound, check for corrosion on wire, bracket or airbag contact ring and ensure horn wire is properly connected.

(3) If bracket needs to be replaced, the steering wheel must be replaced. If contact ring is bad the Driver Airbag Module must be replaced.

(4) Refer to Group 8W, Wiring Diagrams if wire circuit needs to be repaired.

**HORN RELAY**

(1) Remove horn relay from the Junction Block (Fig. 3).

(2) Using ohmmeter, test between the Junction Block relay terminal 7 and ground for continuity.

(a) When the horn contact is not depressed, no continuity.

(b) Continuity to ground when horn contact is depressed.

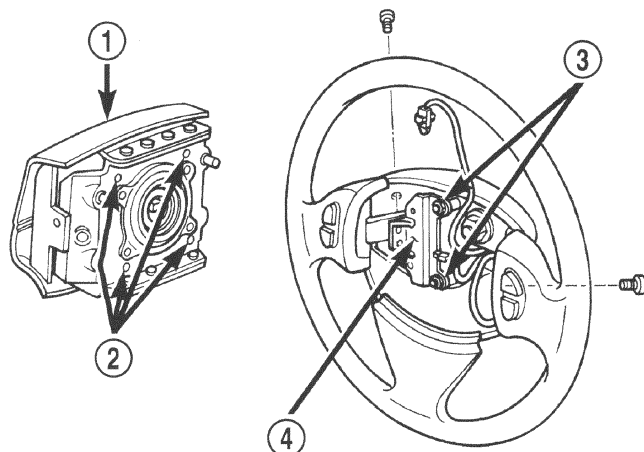
(c) If continuity is not correct, repair horn contact or wiring as necessary. Refer to Group 8W, Wiring diagrams.

(3) Insert a jumper wire between terminals 8 and 10 of the horn relay in the Junction Block.

(a) If horns sound replace relay.

(b) If the horns do not sound, install horn relay and refer to Horn Test.

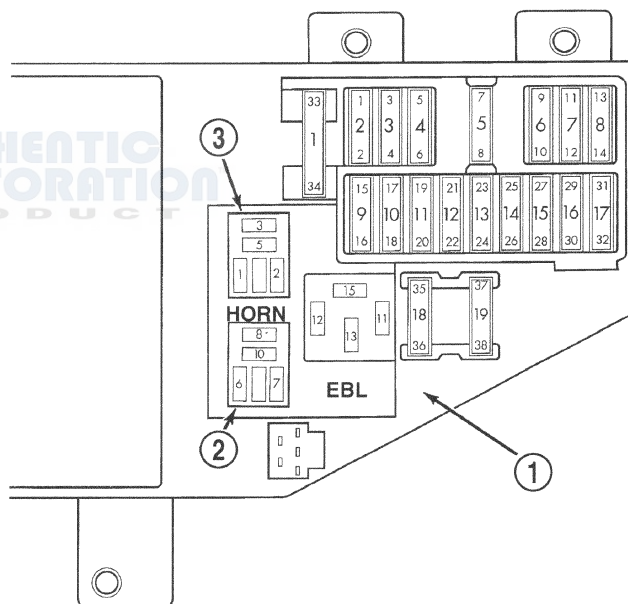
(4) Using voltmeter, test battery voltage:



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**Fig. 2 Horn Contact—Typical**

- 1 – AIR BAG MODULE
- 2 – CONTACT AREA (4) LOCATIONS
- 3 – MOUNTING BOLTS
- 4 – AIR BAG MOUNTING BRACKET



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**Fig. 3 Horn Relay Location**

- 1 – CIRCUIT BREAKERS
- 2 – HORN RELAY
- 3 – H/LP RELAY

(a) Test Junction Block horn relay terminals 6 and 8 for voltage from fuse 8.

(b) If not OK, repair as necessary. Refer to Group 8W, Wiring Diagrams.

**HORNS WILL NOT SOUND**

Check horn fuse 14 in the Power Distribution Center and fuse 8 in the Junction Block. If fuse is blown refer to FUSE BLOWN section. If fuse is OK, refer to FUSE OK section.

**DIAGNOSIS AND TESTING (Continued)****FUSE BLOWN**

(1) Verify condition of battery terminals and voltage, refer to Group 8A, Battery. If battery connections and battery charge is OK, go to Step 2.

(2) Using a voltmeter, test for battery voltage at both sides of horn fuse 8. If voltage is OK, on both sides of fuse, go to Fuse OK. If voltage is OK, on one side of fuse, the fuse is blown, go to Step 3.

(3) Using a suitable ammeter in place of the fuse, test amperage draw of the horn circuit. If amperage draw is greater than 20 amps without the horn switch depressed, a grounded circuit exists between the fuse and the horn relay. Go to Step 4. If amperage draw is greater than 20 amps with the horn switch depressed, a grounded circuit exists between the horn relay and the horn. Go to Step 6.

(4) Remove the horn relay from the Junction Block. If the amperage draw drops to 0 amps, the horn switch or circuit is shorted. Refer to group 8W, Wiring Diagrams for circuit information. If amperage does not drop go to Step 5.

(5) Disconnect both horns. If amperage does not drop with both horns disconnected and the horn switch depressed, go to Step 7. If the amperage draw drops go to Step 6.

(6) Disconnect the wire connector from one of the horns. If amperage drops and the connected horn sounds, reverse the procedure, and replace the faulty horn.

(7) Using a continuity tester, with the horns disconnected test continuity of the X2 cavity of the horn relay to ground. Refer to Group 8W, Wiring Diagrams for circuit information. If continuity is detected, the circuit is grounded between the Junction Block and the horns. Locate and repair pinched harness. If the amperage draw does not drop to 0 amps, repair short at the Junction Block.

**FUSE OK**

(1) Remove the horn relay from the Junction Block.

(2) Using a continuity tester, Depress horn switch and test continuity from the X3 cavity of the horn

relay to ground. Refer to Group 8W, Wiring Diagrams for circuit information.

(a) If continuity is detected, go to Step 3.

(b) If NO continuity, go to Step 4.

(3) Using a suitable jumper wire, jump across the fuse F62 cavity and the X2 cavity of the horn relay in the Junction Block.

(a) If the horn sounds, replace the horn relay.

(b) If the horn does not sound, go to Step 4.

(4) Remove airbag/horn pad from steering wheel. Refer to Group 8M, Restraint Systems for proper procedures.

(5) Test continuity across horn switch connectors with horn switch depressed.

(a) If continuity is detected, repair open circuit between the relay and the horn switch.

(b) If NO continuity, replace airbag cover.

(6) Install horn relay into Junction Block.

(7) Disconnect the wire connectors from horns.

(8) Using a voltmeter, with the horn switch depressed test voltage across horn connector terminals of the wire harness (Fig. 1).

(a) If voltage is detected, replace horns.

(b) If NO voltage, go to Step 9.

(9) With the horn switch depressed, test for voltage between the X2 circuit and ground.

(a) If voltage OK, repair system ground at right cowl area. Refer to Group 8W, Wiring Diagrams.

(b) If NO voltage, repair open X2 circuit between the relay and the horns.

**SYSTEM TEST**

**CAUTION: Continuous sounding of horns will cause horn relay to fail.**

Check fuse 8 in the Junction Block, and refer to Horn System Test table.

Refer to Group 8W, Wiring Diagrams for circuit and wiring information.



**DIAGNOSIS AND TESTING (Continued)****HORN SYSTEM TEST**

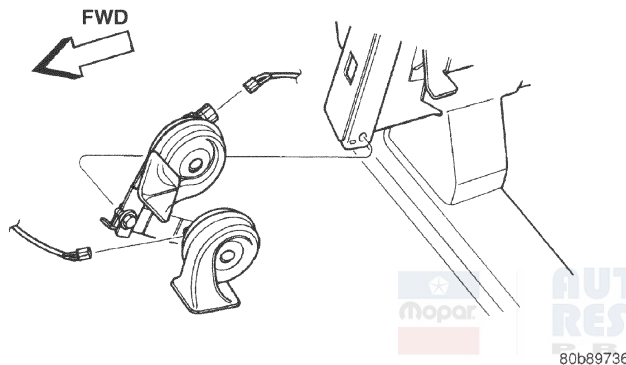
CONDITION	POSSIBLE CAUSE	CORRECTION
HORN SOUNDS CONTINUOUSLY. NOTE: IMMEDIATELY UNPLUG HORN RELAY IN THE JUNCTION BLOCK	(1) FAULTY HORN RELAY. (2) HORN CONTROL CIRCUIT TO RELAY SHORTED TO GROUND. (3) PINCHED HORN SWITCH WIRE UNDER DRIVER AIRBAG MODULE. (4) DEFECTIVE HORN SWITCH	(1) REFER TO HORN RELAY TEST. (2) CHECK HORN RELAY TERMINAL 8 IN THE JUNCTION BLOCK FOR CONTINUITY TO GROUND INDICATES: (A) WIRING HARNESS SHORTED TO GROUND. (B) FIND THE SHORT AND REPAIR AS NECESSARY. (3) REMOVE DRIVER AIRBAG MODULE AND CHECK FOR RUBBING, SHORTED OR LOOSE WIRE CONNECTOR AND REPAIR AS NECESSARY. (4) REPLACE DRIVER AIRBAG MODULE.
HORN SOUND INTERMITTENTLY AS THE STEERING WHEEL IS TURNED.	(1) HORN RELAY CONTROL CIRCUIT X3 IS SHORTED TO GROUND INSIDE STEERING COLUMN OR THE WHEEL. (2) PINCHED HORN SWITCH WIRE UNDER DRIVER AIRBAG MODULE (3) DEFECTIVE HORN SWITCH	(1) REMOVE DRIVER AIRBAG MODULE AND/OR STEERING WHEEL AS NEEDED. CHECK FOR RUBBING OR LOOSE WIRE/CONNECTOR, REPAIR AS NECESSARY. (2) REPLACE DRIVER AIRBAG MODULE. (3) REPLACE DRIVER AIRBAG MODULE.
HORN DOES NOT SOUND	(1) CHECK FUSE 8 IN THE JUNCTION BLOCK. (2) NO VOLTAGE AT HORN RELAY TERMINALS 6 & 8, AND FUSE IS OK. (3) DEFECTIVE OR DAMAGED HORN. (4) DEFECTIVE HORN SWITCH	(1) REPLACE FUSE IF BLOWN AS REPAIR AS NECESSARY. (2) NO VOLTAGE, REPAIR OR REPLACE JUNCTION BLOCK AS NECESSARY. (3) VOLTAGE AT HORN WHEN HORN SWITCH IS PRESSED, REPLACE HORN. (4) REPLACE DRIVER AIRBAG MODULE.
FUSE BLOWS WHEN HORN IS BLOWN	(1) SHORT CIRCUIT IN HORN OR HORN WIRING	(1) REMOVE HORN RELAY, CHECK FOR SHORTED HORN OR HORN WIRING. DISCONNECT HORN WIRE HARNESS TO ISOLATE SHORT AND REPAIR AS NECESSARY.
FUSE BLOWS WITHOUT BLOWING HORN  NOTE: FOR WIRING REPAIRS REFER TO GROUP 8W, WIRE DIAGRAMS.	(1) SHORT CIRCUIT	(1) REMOVE RELAY, INSTALL NEW FUSE, IF FUSE DOES NOT BLOW REPLACE HORN RELAY. IF FUSE BLOWS WITH RELAY REMOVED, CHECK FOR SHORT TO GROUND WITH OHMMETER ON CIRCUIT BETWEEN TERMINALS 6 & 8 AND THE FUSE TERMINAL. REPAIR AS NECESSARY.

## REMOVAL AND INSTALLATION

### HORNS

#### REMOVAL

- (1) Disconnect and isolate the battery negative remote cable.
- (2) Hoist and support front vehicle on safety stands.
- (3) The horns are located behind the front fascia on the right front frame rail. Remove the splash shield as necessary for access.
- (4) Disconnect the wire connector from the horn.
- (5) Remove mount bracket attaching bolt from the front frame rail. Do not remove horn from mounting bracket (Fig. 4).



**Fig. 4 Horn Location**

- (6) Remove horn from vehicle.

#### INSTALLATION

For installation, reverse the above procedures.

### HORN CONTACT SWITCH

**WARNING: BEFORE BEGINNING ANY AIRBAG SYSTEM REMOVAL OR INSTALLATION PROCEDURES, REMOVE AND ISOLATE THE BATTERY NEGATIVE CABLE FROM THE VEHICLE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**

#### REMOVAL

- (1) Disconnect and isolate the battery negative remote cable.
- (2) Remove the screws that attach the Driver Airbag Module to the steering wheel.
- (3) Lift the module to gain access and disconnect the squib wire.
- (4) Place Driver Airbag Module on a clean level surface with pad facing upward.
- (5) If the contact area is bad, replace Driver Airbag Module. If the mounting bracket or bushings are bad, replace steering wheel.

#### INSTALLATION

For installation, reverse the above procedures. Use caution not to pinch wires.

### HORN RELAY

#### REMOVAL

- (1) Disconnect and isolate the battery negative remote cable.
- (2) Open driver's door and remove instrument panel end cover.
- (3) Remove horn relay (Fig. 3).

#### INSTALLATION

For installation, reverse the above procedures.

# VEHICLE SPEED CONTROL SYSTEM

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## DESCRIPTION AND OPERATION

### SPEED CONTROL SYSTEM

#### DESCRIPTION

The speed control system is electronically controlled and vacuum operated. The electronic control is integrated into the powertrain control module, located on the left side of the engine compartment next to the air cleaner. The controls are located on the steering wheel and consist of five switches. The ON and OFF buttons are located on the left side of the airbag module. The RESUME, ACCEL, SET, COAST and CANCEL buttons are located on the right side of the airbag module (Fig. 1). For identification and location of the major components (Fig. 2).

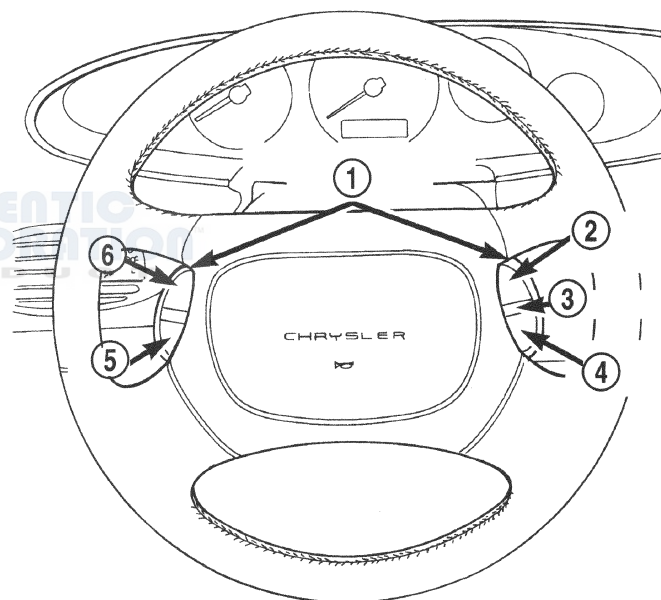
The system is designed to operate at speeds above 30 mph (50 km/h).

**WARNING: THE USE OF SPEED CONTROL IS NOT RECOMMENDED WHEN DRIVING CONDITIONS DO NOT PERMIT MAINTAINING A CONSTANT SPEED, SUCH AS IN HEAVY TRAFFIC OR ON ROADS THAT ARE WINDING, ICY, SNOW COVERED, OR SLIPPERY.**

#### OPERATION

When speed control is activated by depressing the ON switch, the PCM allows a set speed to be stored in RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between 30 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:



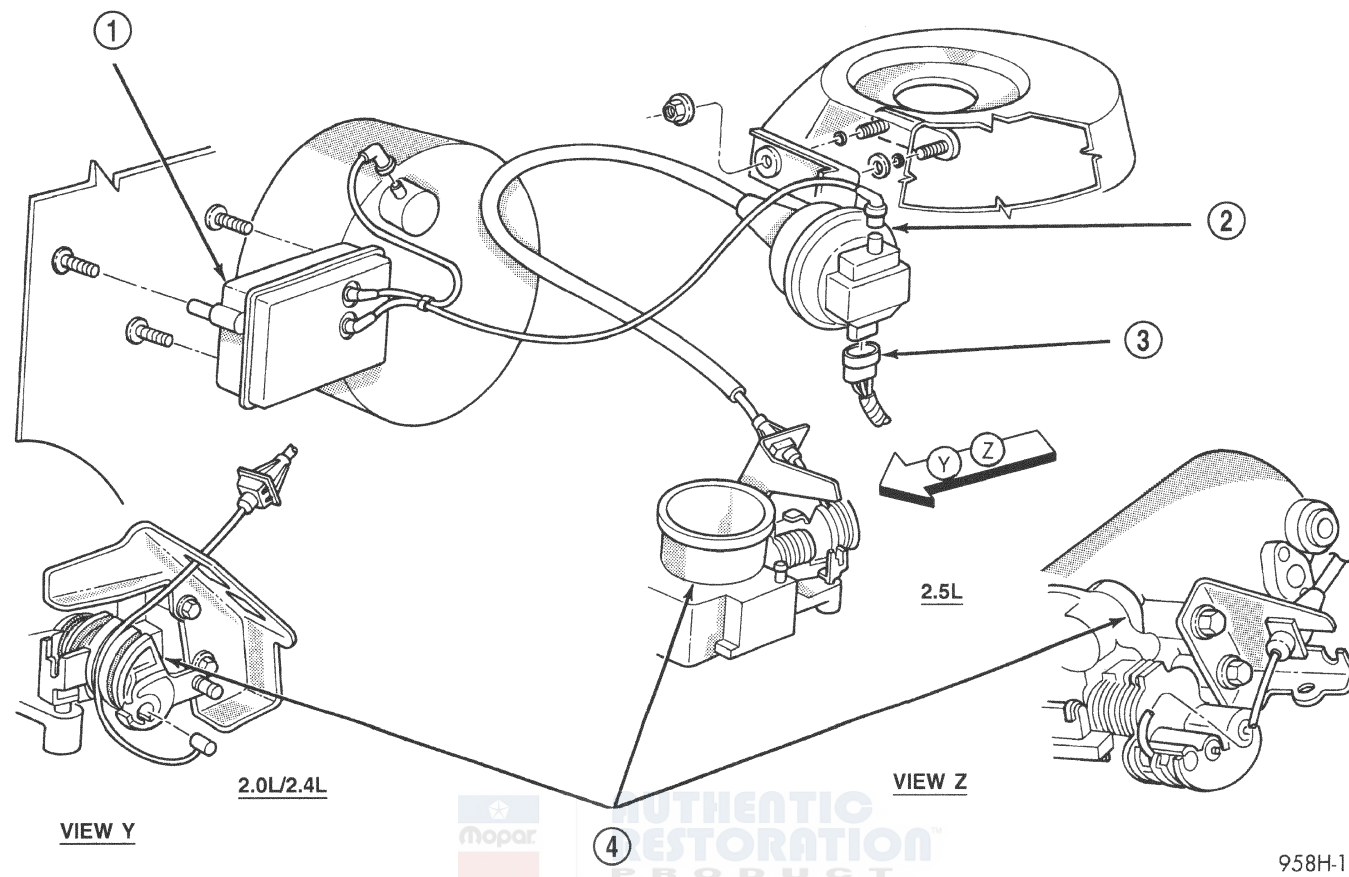
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**Fig. 1 Speed Control Switch**

- 1 - SPEED CONTROL SWITCHES
- 2 - RES  
ACCEL
- 3 - CANCEL
- 4 - SET  
COAST
- 5 - OFF
- 6 - ON

- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.
- Depressing the clutch pedal



**DESCRIPTION AND OPERATION (Continued)****Fig. 2 Speed Control System**

1 - VACUUM RESERVOIR  
2 - SPEED CONTROL SERVO

3 - SERVO CONNECTOR  
4 - THROTTLE BODY

958H-15

**NOTE:** Depressing the OFF switch or turning off the ignition switch will erase the set speed stored in the PCM.

For added safety, the speed control system is programmed to disengage for any of the following conditions:

- An indication of Park or Neutral
- A rapid increase rpm (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The speed signal increases at a rate of 10 mph per second (indicates that the co-efficient of friction between the road surface and tires is extremely low)
- The speed signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)

Once the speed control has been disengaged, depressing the RESUME switch when speed is greater than 25 mph allows the vehicle to resume control to the target speed that was stored in the PCM.

While the speed control is engaged, the driver can increase the vehicle speed by depressing the ACCEL switch. The new target speed is stored in the PCM when the ACCEL switch is released. The PCM also has a "tap-up" feature in which target speed increases by 2 mph for each momentary switch activation of the ACCEL switch. The PCM also provides a means to decelerate to a new lower target speed without disengaging speed control. Depress and hold the COAST switch until the desired speed is reached, then release the switch.

**SPEED CONTROL SERVO-PCM OUTPUT****DESCRIPTION**

The servo unit consists of a solenoid valve body, and a vacuum chamber. The solenoid valve body contains three solenoids:

- Vacuum
- Vent
- Dump

The vacuum chamber contains a diaphragm with a cable attached to control the throttle linkage.

**DESCRIPTION AND OPERATION (Continued)****OPERATION**

The PCM controls the solenoid valve body. The solenoid valve body controls the application and release of vacuum to the diaphragm of the vacuum servo. The servo unit cannot be repaired and is serviced only as a complete assembly.

Power is supplied to the servo by the PCM through the brake switch. The PCM controls the ground path for the vacuum and vent solenoids.

The dump solenoid is energized anytime it receives power. If power to the dump solenoid is interrupted, the solenoid dumps vacuum in the servo. This provides a safety backup to the vent and vacuum solenoids.

The vacuum and vent solenoids must be grounded at the PCM to operate. When the PCM grounds the vacuum servo solenoid, the solenoid allows vacuum to enter the servo and pull open the throttle plate using the cable. When the PCM breaks the ground, the solenoid closes and no more vacuum is allowed to enter the servo. The PCM also operates the vent solenoid via ground. The vent solenoid opens and closes a passage to bleed or hold vacuum in the servo as required.

The PCM duty cycles the vacuum and vent solenoids to maintain the set speed, or to accelerate and decelerate the vehicle. To increase throttle opening, the PCM grounds the vacuum and vent solenoids. To decrease throttle opening, the PCM removes the grounds from the vacuum and vent solenoids.

**SPEED CONTROL SWITCHES****DESCRIPTION**

There are two separate switch pods that operate the speed control system.

**OPERATION**

The steering-wheel-mounted switches use multiplexed circuits to provide inputs to the PCM for ON, OFF, RESUME, ACCELERATE, SET, DECEL and CANCEL modes. Refer to the owner's manual for more information on speed control switch functions and setting procedures.

The individual switches cannot be repaired. If one switch fails, the entire switch module must be replaced.

**INTERACTIVE SPEED CONTROL****DESCRIPTION**

Interactive means that communication between the PCM and the TCM is taking place. Interactive speed

control avoids unnecessary shifting for smoother, quieter operation and when downshifts are required, makes the shifts smoother.

**CLIMBING A GRADE****DESCRIPTION**

When climbing a grade the interactive speed control tries to maintain the set speed by increasing the throttle opening, while inability/delaying downshifts.

**OPERATION**

If opening the throttle alone cannot maintain the set speed and the vehicle speed drops more than three mph below the set speed, the transmission will downshift to third gear. If the vehicle continues to lose speed, by more than 6 mph, the transmission will downshift again maintain the set speed. After the vehicle encounters a less-steep grade, or has crested the grade (reduced the load on the powertrain) and can maintain the set speed at a reduced throttle position, the transmission will upshift, as appropriate, until the set speed can be maintained in Overdrive.

**DOWNSHIFT DELAY****DESCRIPTION**

Downshift delay features have been added to reduce the number and frequency of downshifts when operating in hilly or mountainous country.

**OPERATION**

While operating, interactive speed control delays or avoids downshifts by allowing up to nearly wide open throttle without the TCM scheduling a downshift. If the interactive speed control is not engaged or the throttle is manually overridden by the driver while interactive speed control is engaged, the downshift delay feature is not activated.

Torque converter lock and unlock shifts are not affected by the downshift delay feature and will occur at the same throttle angle at a given speed regardless of whether interactive speed control operates or not.

**GRADE HUNTING****DESCRIPTION**

All vehicles equipped with a four speed automatic transmission have a grade hunting feature for the 2nd to 3rd gear upshift and the 3rd to Overdrive upshift.



**DESCRIPTION AND OPERATION (Continued)****OPERATION**

The TCM identifies the powertrain loading conditions and selects the proper gear to maintain the current vehicle speed. Under moderate loading conditions the transaxle will stay in 3rd gear until the top of the grade is reached or the powertrain loading is reduced.

If powertrain loading is severe, the transaxle may shift into 2nd gear and remain there until powertrain loading is reduced, then a 2nd to 3rd gear upshift will be scheduled. Grade hunting features always operate regardless of whether or not the interactive speed control is engaged. **If the interactive speed control is not engaged and powertrain loading is not reduced, the driver may have to completely lift off of the throttle before an upshift will occur.** If the driver does lift off the throttle to induce an upshift under these conditions, vehicle speed will reduce and the Overdrive to 3rd and 3rd to 2nd gear downshifts will reoccur when the throttle is reapplied. If grade hunting is repeatedly induced by the driver, transaxle damage may result.

**AUTOMATIC SPEED CONTROL OVERSPEED REDUCTION****DESCRIPTION**

Transmission control software includes an automatic speed control overspeed reduction feature. This maintains vehicle speed at the selected set point when descending a grade.

**OPERATION**

The Transmission Control Module (TCM) first senses that the speed control is set. If the set speed is exceeded by more than 4 mph (6.5 km/hr) and the throttle is closed, the TCM causes the transaxle to downshift to THIRD gear. After downshifting, the automatic speed control resumes normal operation. To ensure that an upshift is appropriate after the set speed is reached, the TCM waits until the speed control system opens the throttle at least 6 degrees before upshifting to OVERDRIVE again.

If the driver applies the brakes, canceling automatic speed control operation with the transaxle still in THIRD gear, the TCM maintains this gear until the driver opens the throttle at least 6 degrees to avoid an inappropriate upshift. The upshift is also delayed for 2.5 seconds after reaching the 6 degrees throttle opening in anticipation that the driver might open the throttle enough to require THIRD gear. This will avoid unnecessary and disturbing transmission cycling. If the automatic speed control RESUME feature is used after braking, the upshift is delayed until the set speed is achieved to reduce cycling and provide better response.

**BRAKE LAMP SWITCH****DESCRIPTION**

The switch is mounted on the brake pedal mounting bracket under the instrument panel.

**OPERATION**

Vehicles equipped with the speed control option use a dual function brake lamp switch. The PCM monitors the state of the dual function brake lamp switch. Refer to the Brake section for more information on brake lamp switch service and adjustment procedures.

The brake switch is equipped with three sets of contacts, one normally open and the other two normally closed (brakes disengaged). The PCM sends a 12 volt signal to one of the normally closed contacts in the brake switch, which is returned to the PCM as a brake switch state signal. With the contacts closed, the 12 volt signal is pulled to ground causing the signal to go low. The low voltage signal, monitored by the PCM, indicates that the brakes are not applied. When the brakes are applied, the contacts open, causing the PCM's output brake signal to go high, disengaging the speed control, cutting off PCM power to the speed control solenoids.

The second set of normally closed contacts supplies 12 volts from the PCM any time speed control is turned on. Through the brake switch, current is routed to the speed control servo solenoids. The speed control solenoids (vacuum, vent and dump) are provided this current any time the speed control is ON and the brakes are disengaged.

When the driver applies the brakes, the contacts open and current is interrupted to the solenoids. The normally open contacts are fed battery voltage. When the brakes are applied, battery voltage is supplied to the brake lamps.

**SERVO CABLE****DESCRIPTION**

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle body control linkage.

**OPERATION**

This cable causes the throttle control linkage to open or close the throttle valve in response to movement of the vacuum servo diaphragm.

**POWERTRAIN CONTROL MODULE****DESCRIPTION**

The PCM is located in the engine compartment.



## DESCRIPTION AND OPERATION (Continued)

### OPERATION

The speed control electronic control circuitry is integrated into the Powertrain Control Module (PCM). The PCM speed control functions are monitored by the On-Board Diagnostics (OBD). All OBD-sensed systems are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for any failure it detects. The PCM cannot be repaired and must be replaced if faulty.

**USE THE DRB SCAN TOOL TO REPROGRAM THE NEW PCM WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE VEHICLES ORIGINAL MILEAGE. IF THIS STEP IS NOT DONE A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.**

### VACUUM RESERVOIR

The vacuum reservoir is located in the engine compartment.

### OPERATION

The reservoir stores engine vacuum in the reservoir. When engine vacuum drops, as in climbing a grade while driving, the reservoir supplies the vacuum needed to maintain proper speed control operation. The vacuum reservoir cannot be repaired and must be replaced if faulty.

### VEHICLE SPEED AND DISTANCE

### OPERATION

The 4 speed automatic Transmission Control Module (TCM) supplies the speed input to the PCM. The PCM determines acceleration rates. The speed control software in the PCM uses vehicle speed and acceleration to control to the set speed.

Vehicles with a 3 speed automatic or manual transmission have a Vehicle Speed Sensor (VSS) mounted to an adapter near the transmission output shaft. The sensor is driven through the adapter by a speedometer pinion gear. The VSS pulse signal is monitored by the PCM to determine vehicle speed and to maintain speed control set speed. Refer to the appropriate Powertrain Diagnostic Procedures manual for diagnosis and testing of this component.

### ROAD TEST

### OPERATION

Perform a vehicle road test to verify reports of speed control system malfunction. The road test should include attention to the speedometer. Speedometer operation should be smooth and without flutter at all speeds.

Flutter in the speedometer indicates a problem which might cause surging in the speed control system. The cause of any speedometer problems should be corrected before proceeding. Refer to the Instrument Panel and Gauges for speedometer diagnosis.

If a road test verifies a surge following a set and the speedometer operates properly see "Overshoot/Undershoot on speed control set".

If a road test verifies an inoperative system, and the speedometer operates properly, check for:

- A Diagnostic Trouble Code (DTC). If a DTC exists, conduct tests per the Powertrain Diagnostic Procedures service manual.
- A misadjusted brake (stop) lamp switch. This could also cause an intermittent problem.
- Loose or corroded electrical connections at the servo. Corrosion should be removed from electrical terminals and a light coating of Mopar Multipurpose Grease, or equivalent, applied.
- Leaking vacuum reservoir.
- Loose or leaking vacuum hoses or connections.
- Defective one-way vacuum check valve.
- Secure attachment at both ends of the speed control servo cable.
- Smooth operation of throttle linkage and throttle body air valve.
- Conduct electrical test at PCM.
- Failed speed control servo. Do the servo vacuum test.

**CAUTION:** When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals or seals. If these components are damaged, intermittent or complete system failure may occur.

## CHECKING FOR DIAGNOSTIC CODES

### OPERATION

When trying to verify a speed control system electronic malfunction: Connect a DRB scan tool if available to the data link connector. The connector is located at left side of the steering column, and at lower edge of the panel.

(1) A speed control malfunction may occur without a diagnostic code being indicated.

For further information and usage of the DRB scan tool and a more complete list of Diagnostic Trouble Code and No Trouble Codes, refer to the Powertrain Diagnostic Manual.

## REMOVAL AND INSTALLATION

### SERVO

#### REMOVAL

- (1) Remove the negative battery cable.
- (2) Disconnect the vacuum hose from servo.
- (3) Remove two nuts attaching speed control cable and mounting bracket to servo.
- (4) Remove servo from the mounting bracket.
- (5) Disconnect electrical connectors and vacuum hose.
- (6) Remove cable from throttle cam. Refer to Speed Control Servo Cable Removal/Installation in this section.
- (7) Remove clip attaching cable to servo.

#### INSTALLATION

- (1) Install servo cable through large hole in bracket, to servo and install clip.
- (2) Install speed control cable to throttle cam. Refer to Speed Control Servo Cable Removal/Installation in this section.
- (3) Connect electrical connector.
- (4) Insert servo studs through holes in speed control mounting bracket and cable.
- (5) Install nuts, tighten to 7 N·m (60 in. lbs.).
- (6) Connect the vacuum hose to servo.
- (7) Install the negative battery cable.

### SPEED CONTROL SWITCH

The speed control switches are mounted in the steering wheel and wired through the clock spring device under the airbag module (Fig. 1).

**WARNING: IF REMOVAL OF AIRBAG MODULE IS NECESSARY, REFER TO THE RESTRAINT SYSTEMS.**

#### REMOVAL

- (1) Remove the negative battery cable.
- (2) Turn off ignition.
- (3) Remove two screws from side of each switch.
- (4) Rock switch away from airbag and steering wheel.
- (5) Disconnect two-way electrical connector.
- (6) Repeat for the other switch.

#### INSTALLATION

- (1) Connect two-way electrical connector.
- (2) Install switches.
- (3) Install two screws to the side of each switch.
- (4) Install airbag, refer to the Restraint Systems
- (5) Install the negative battery cable.

### SPEED CONTROL SERVO CABLE

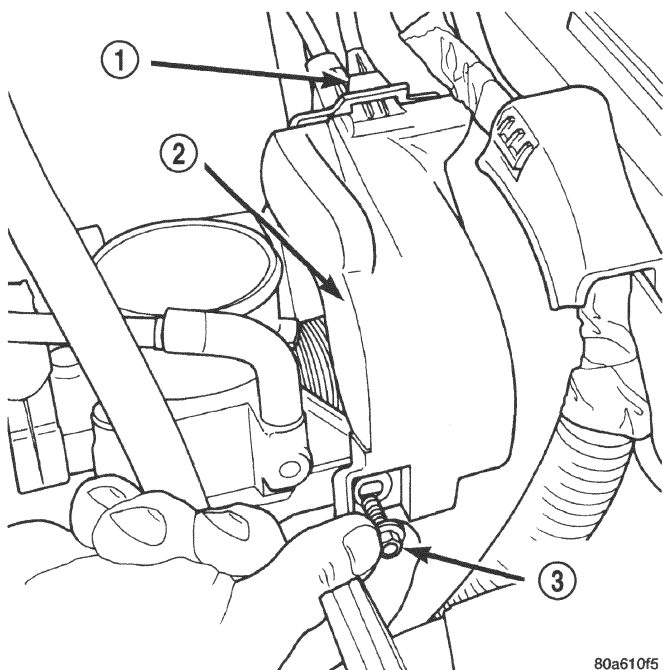
#### REMOVAL

- (1) Remove the negative battery cable.
- (2) Remove the air inlet resonator.
- (3) Remove throttle control shield, if equipped (Fig. 3).
- (4) Remove throttle cable clasp from the throttle body cam.
- (5) Remove speed control cable from throttle cam by sliding clasp out hole used for throttle cable.
- (6) Compress the retaining tabs on the cable and slide cable out of bracket.
- (7) Remove 2 nuts retaining cable and bracket to servo.
- (8) Slide cable bell housing off of servo mounting studs.
- (9) Remove retaining clip holding cable to servo.

#### INSTALLATION

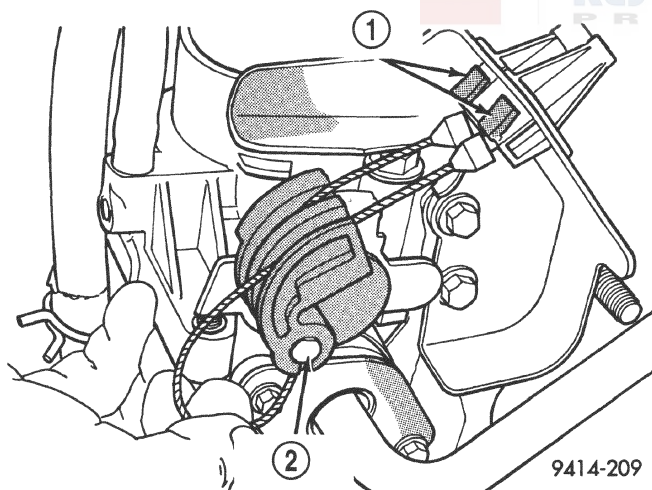
- (1) Install cable core wire through center hole on bracket, onto servo center post.
- (2) Install retaining clip to cable at servo.
- (3) Slide cable bell housing over servo mounting studs (bracket in between).
- (4) Install 2 nuts at cable to and servo bracket to servo, tighten to 7 N·m (60 ins. lbs.).
- (5) Slide cable into throttle cable bracket and engage retaining tabs.
- (6) Rotate the throttle cam forward to the wide open position and install speed control cable clasp.
- (7) Rotate the throttle cam forward to the wide open position and install throttle cable clasp.
- (8) Install throttle control shield, if equipped.
- (9) Install the air inlet resonator.
- (10) Install the negative battery cable.

**REMOVAL AND INSTALLATION (Continued)**



**Fig. 3 Throttle Control Shield**

- 1 - MOUNTING TAB
- 2 - THROTTLE CONTROL SHIELD
- 3 - MOUNTING SCREW



**Fig. 4 Disconnecting Throttle Cable—Typical**

- 1 - TABS
- 2 - CABLE CLASP

**VACUUM RESERVOIR**

The vacuum reservoir is located on the dash panel next to the brake booster.

**REMOVAL**

- (1) **2.5L ONLY** Remove the intake manifold, refer to the Engine section.
- (2) Disconnect vacuum hoses from reservoir.
- (3) Pull vacuum reservoir from dash panel.

**INSTALLATION**

- (1) Push reservoir onto dash panel.
- (2) Connect hoses to reservoir.
- (3) **2.5L ONLY** Install intake manifold, refer to the Engine section.



# TURN SIGNAL AND HAZARD WARNING SYSTEMS

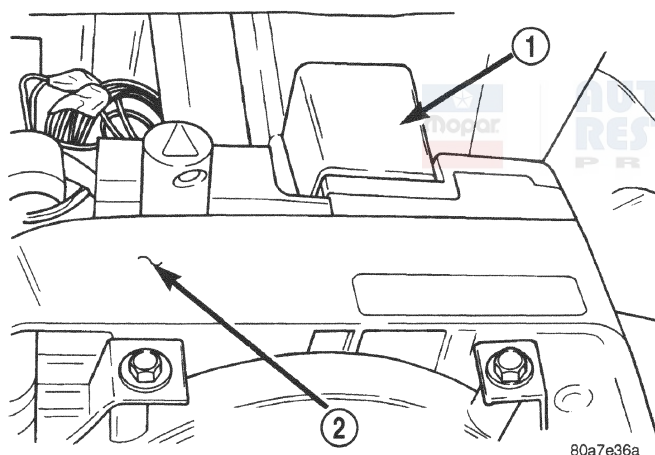
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## DESCRIPTION AND OPERATION

### COMBINATION FLASHER

#### DESCRIPTION



**Fig. 1 Combination Flasher Location**

- 1 - COMBINATION FLASHER  
2 - MULTI-FUNCTION SWITCH

The turn signal flasher and the hazard warning flasher are combined into one unit called a combination flasher (combo-flasher).

#### OPERATION

An inoperative or incomplete turn signal circuit will result in an increase in flasher speed.

The flasher is mounted to the back side of the multi-function switch.

## EXTERIOR LAMPS

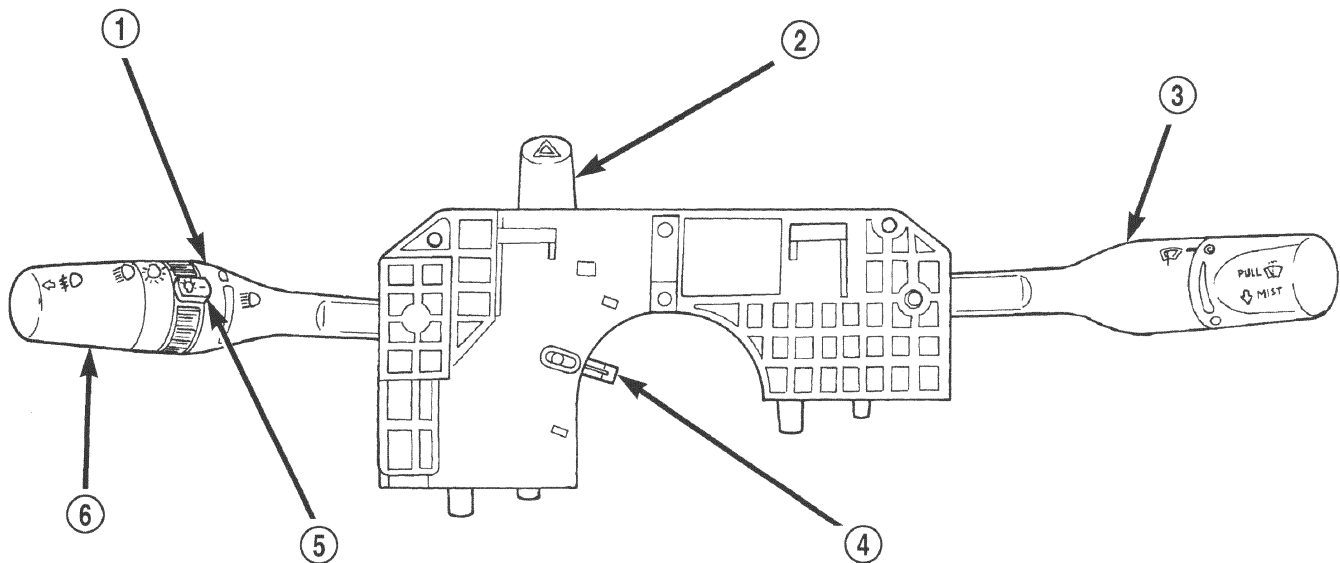
### DESCRIPTION

The exterior lamps are controlled by a rotary switch located on the left stalk of the multi-function switch on the steering column.

### OPERATION

To turn lamps ON:

- Parking lamps, using left stalk turn headlamp switch to the first detent
- Headlamps, turn switch to second detent
- Headlamp beam select, from low beam to high beam or high to low, pull left stalk towards steering wheel. The ignition switch must be in the RUN position for the instrument panel high beam indicator to light.
- Headlamp optical horn, pull left stalk towards steering wheel, headlamps will stay ON as long as stalk is held.
- Fog lamps, pull switch outward with headlamps on low beam
- Panel dimmer, rotating dimmer switch regulates intensity of the instrument panel illumination. There are nine detents (steps) of intensity. Detent #1 is full brightness and each detent thereafter is lower. Testing the dimmer switch using the continuity test, the resistance value is measured for each detent. Detents #3 through #8 are measured in equal graduations, up or down and referred to as linear. Example: if detent #3 was #5 ohms and detent #4 was 7 ohms detent #5 should be 9 ohms.

**DESCRIPTION AND OPERATION (Continued)**

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**Fig. 2 Multi-Function/Exterior Lamp Switch**

- 1 - TURN SIGNAL CONTROL STALK
- 2 - HAZARD WARNING BUTTON
- 3 - WINDSHIELD WIPER/WASHER CONTROL

- 4 - CANCELING ACTUATOR
- 5 - PANEL DIMMER SWITCH
- 6 - EXTERIOR LIGHTING CONTROL

**HAZARD WARNING SYSTEM**

**AUTHENTIC  
RESTORATION  
PRODUCT**

**DESCRIPTION**

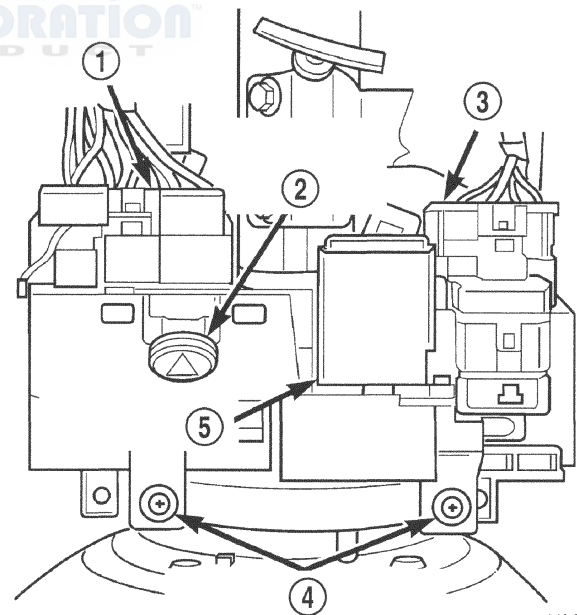
The hazard warning switch push button protrudes from the top of the steering column. The hazard warning switch push button is identified with a double triangle, which is the international control symbol for hazard warning.

**OPERATION**

The hazard warning system is actuated by a push button located on the top of the steering column between the steering wheel and the instrument panel. The hazard switch is identified with a double triangle on top of the button. Push and release the button to turn the hazard function ON or OFF. The button will move out from the steering column in the ON position and will remain in toward the column in the OFF position.

**MULTI-FUNCTION SWITCH**

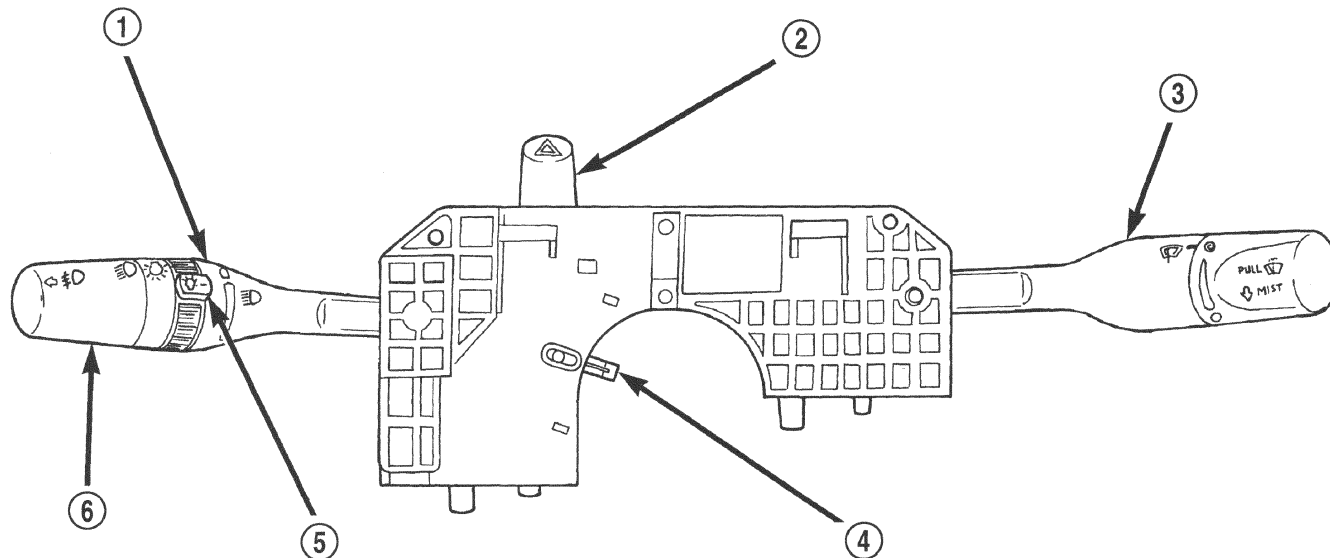
**WARNING: ON VEHICLES EQUIPPED WITH AIRBAG, SEE GROUP 8M, PASSIVE RESTRAINT SYSTEMS FOR AIRBAG REMOVAL PROCEDURES.**



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**Fig. 3 Hazard Warning Switch**

- 1 - MULTI-FUNCTION SWITCH CONNECTOR
- 2 - HAZARD WARNING SWITCH
- 3 - FLASHER AND WINDSHIELD WIPER/WASHER SWITCH CONNECTOR
- 4 - MOUNTING SCREWS
- 5 - COMBINATION FLASHER

**DESCRIPTION AND OPERATION (Continued)****DESCRIPTION**

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**Fig. 4 Multi-Function Switch**

- 1 - TURN SIGNAL CONTROL STALK  
 2 - HAZARD WARNING BUTTON  
 3 - WINDSHIELD WIPER/WASHER CONTROL

- 4 - CANCELING ACTUATOR  
 5 - PANEL DIMMER SWITCH  
 6 - EXTERIOR LIGHTING CONTROL

The multi-function switch contains:

- Turn signals
- Hazard warning
- Headlamps
- Headlamp beam select
- Parking lamps
- Panel dimmer
- Fog Lamp
- Headlamp optical horn
- Windshield wiper
- Pulse wipe
- Mist wipe
- Windshield washer switches.

The multi-function switch is mounted center of the steering column. There are two levers, one on each side of the steering column.

**OPERATION**

The left side controls the signaling and lighting. The right side controls the windshield wiper and washer system. When the driver wishes to signal his intentions to change direction of travel, he moves the left lever upward to cause the right signals to flash and downward to cause the left signals to flash. After completion of a turn the system is deactivated automatically. As the steering wheel returns to the

straight ahead position the turn signals are canceled. A canceling cam is molded to the clockspring mechanism which comes in contact with the cancel actuator on the multi-function switch. The canceling cam lobe pushes on the cancel actuator and returns the switch to the off position.

If only momentary signaling such as indication of a lane change is desired, the switch is actuated to a left or right intermediate detent position. In this position the signal lamps flash as described above, but the switch returns to the OFF position as soon as the lever is released.

When the system is activated, one of two indicator lamps mounted in the instrument cluster flashes in unison with the turn signal lamps, indicating to the driver that the system is operating. The windshield wiper and wash system is covered in Group 8K, Windshield Wipers and Washers.

**DIAGNOSIS AND TESTING****COMBINATION FLASHER**

For combination flasher Diagnosis and Testing, refer to the Combination Flasher Diagnosis table.



**DIAGNOSIS AND TESTING (Continued)****COMBINATION FLASHER DIAGNOSIS**

CONDITION	POSSIBLE CAUSES	CORRECTION
SYSTEM DOES NOT FLASH ON ONE SIDE, INDICATOR LAMP FLASHES AT DOUBLE NORMAL RATE.	1) FAULTY EXTERNAL LAMP. 2) POOR GROUND AT LAMP. 3) OPEN CIRCUIT IN WIRING TO EXTERNAL LAMP. 4) FAULTY CONTACT ON SWITCH.	1) REPLACE LAMP. 2) CHECK AND/OR REPLACE WIRING. 3) REPLACE WIRING HARNESS. CHECK CONNECTORS. 4) REPLACE MULTIFUNCTION SWITCH.
INDICATOR LAMP FLASHES AT DOUBLE THE NORMAL RATE. EXTERNAL LAMP-DIM AND FLASHES RAPIDLY OR NO FLASH	1) LOOSE OR CORRODED EXTERNAL LAMP CONNECTION. 2) POOR GROUND CIRCUIT OR EXTERNAL LAMP.	1) REPLACE SOCKET/HARNESS. 2) REPLACE WIRING/HARNESS. CHECK CONNECTORS.
HAZARD WARNING MALFUNCTION/SYSTEM DOES NOT FLASH	1) FAULTY FUSE. 2) FAULTY FLASHER. 3) OPEN CIRCUIT IN FEED WIRE TO SWITCH. 4) FAULTY CONTACT IN SWITCH. 5) OPEN OR GROUNDED CIRCUIT IN WIRING TO EXTERNAL LAMPS.	1) REPLACE FUSE. 2) REPLACE FLASHER. 3) REPLACE WIRING/HARNESS. CHECK CONNECTORS. 4) REPLACE MULTIFUNCTION SWITCH. 5) REPLACE WIRING/HARNESS.
INDICATOR LAMP FLASHES AT DOUBLE NORMAL RATE, EXTERNAL LAMP DOES NOT LIGHT	1) OPEN CIRCUIT IN WIRE TO EXTERNAL LAMP. 2) BURNED OUT LAMP.	1) REPLACE WIRING/HARNESS. 2) REPLACE LAMP.
SYSTEM DOES NOT FLASH ON EITHER SIDE	1) FAULTY FUSE. 2) FAULTY FLASHER UNIT. 3) LOOSE BULKHEAD CONNECTOR. 4) LOOSE OR FAULTY REAR WIRING/HARNESS OR TERMINALS. 5) OPEN CIRCUIT TO FLASHER UNIT. 6) OPEN CIRCUIT IN FEED WIRE TO TURN SIGNAL SWITCH. 7) FAULTY SWITCH CONNECTION. 8) OPEN OR GROUNDED CIRCUIT IN WIRING TO EXTERNAL LAMPS. 9) BURNED OUT LAMPS.	1) REPLACE FUSE. 2) REPLACE FLASHER. 3) TIGHTEN CONNECTOR. 4) REPLACE WIRING/HARNESS. 5) CHECK CONNECTORS, REPLACE WIRING/HARNESS. 6) CHECK CONNECTORS, REPLACE WIRING/HARNESS. 7) REPLACE SWITCH. 8) REPLACE WIRING/HARNESS. 9) REPLACE LAMPS.
SYSTEM DOES NOT CANCEL AFTER COMPLETION OF TURN	1) BROKEN CANCELLING FINGER ON SWITCH. 2) BROKEN OR MISSING CANCELLING CAM ON CLOCKSPring. 3) STICKING CANCELLING FINGER ON MULTIFUNCTION SWITCH.	1) REPLACE MULTIFUNCTION SWITCH. 2) REPLACE CLOCKSPring. 3) REPLACE MULTIFUNCTION SWITCH.

## DIAGNOSIS AND TESTING (Continued)

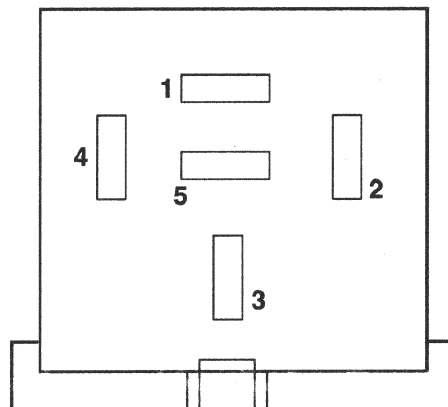
CONDITION	POSSIBLE CAUSES	CORRECTION
EXTERNAL LAMPS OPERATE PROPERLY, NO INDICATOR LAMP OPERATION	1) FAULTY INDICATOR LAMP IN INSTRUMENT CLUSTER.	1) REPLACE LAMP.

### MULTI-FUNCTION SWITCH

(1) Remove multi-function switch, refer to Multi-function Switch Removal and Installation in this section.

(2) Using an ohmmeter, test for continuity (no resistance) between the terminals of the switch as shown in the Multi-Function Switch Continuity Test table and (Fig. 5).

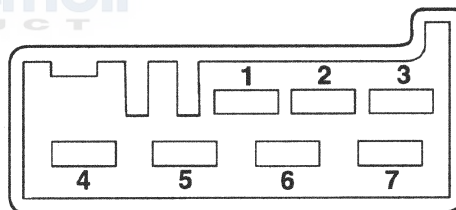
The switch assembly is mounted over the center of the steering column. Should any function of the switch fail, the entire switch assembly must be replaced.



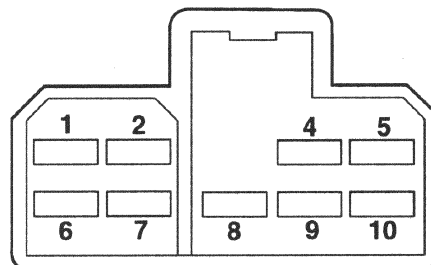
COMBO-FLASHER-A



**AUTHENTIC  
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PRODUCT**



7-WAY CONNECTOR-B



10-WAY CONNECTOR-C

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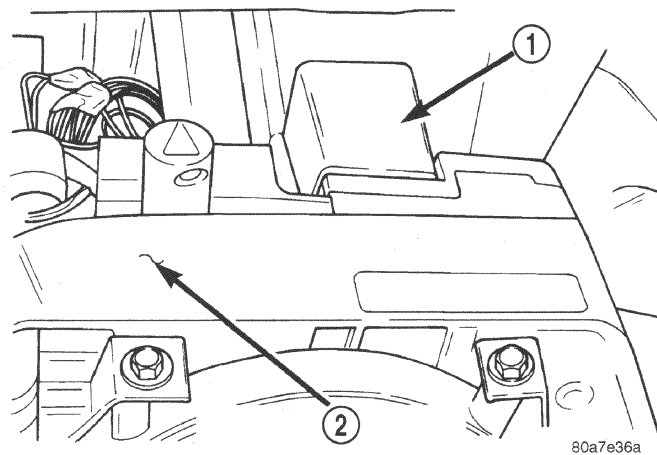
**Fig. 5 Multi-Function Switch Connectors**

**DIAGNOSIS AND TESTING (Continued)****MULTI-FUNCTION SWITCH CONTINUITY TEST**

SWITCH POSITION	MODE	CONTINUITY BETWEEN
TURN SIGNAL WITH HAZARD SWITCH OFF	RIGHT	A-1 AND B-6
	LEFT	A-1 AND B-7
TURN SIGNAL WITH HAZARD WARNING SWITCH ON	RIGHT, OFF, OR LEFT	A-1 AND B-6 A-2 AND A-5 A-1 AND B-7 B-6 AND B-7
HEADLAMP BEAM ON	PARK	C-2 AND C-1
	LOW	C-2 AND C-1 C-4 AND C-7
	HIGH	C-2 AND C-1 C-4 AND C-8
PANEL DIMMER DETENT	1	A-2 AND C-6
	2	<100Ω
	3 TO 8	300 TO 2630 Ω
	9	LINEAR 4.99K TO 10.5K Ω
OPTICAL HORN	ON	C-4 AND C-8
FRONT FOG	ON	C-9 AND C-10
WIPER	INT. DETENT	B-3 AND B-2 11.87K Ω
	1	9.87K Ω
	2	7.87K Ω
	3	5.87K Ω
	4	3.87K Ω
	5	1.87K Ω
	6	
	LOW	B-3 AND B-2 1.25K Ω
	HIGH	B-3 AND B-2 0.82K Ω
MIST	ON	B-3 AND B-2 1.25K Ω
WASHER	ON	B-3 AND B-1

**REMOVAL AND INSTALLATION****COMBINATION FLASHER**

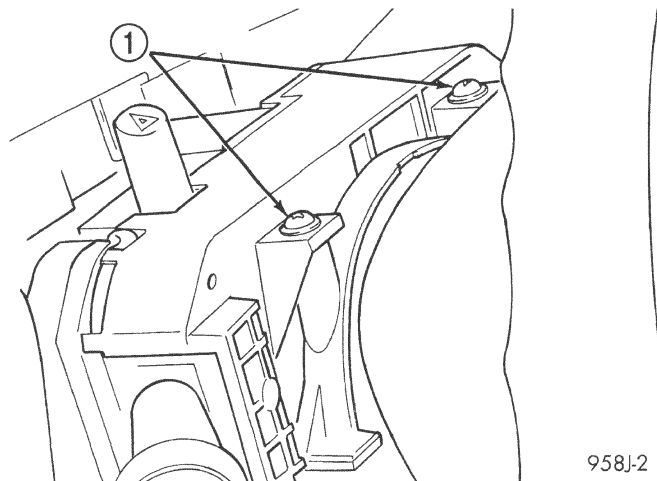
The flasher is mounted to the back side of the multi-function switch. To gain access, the upper steering column cover must be removed. Refer to Steering Column Cover Removal and Installation in this section. The flasher can be removed by pulling it forward. The flasher is serviced separately from the multi-function switch. The flasher is black in color for ease of identification (Fig. 6).

**Fig. 6 Combination Flasher Location**

- 1 - COMBINATION FLASHER  
2 - MULTI-FUNCTION SWITCH

**MULTI-FUNCTION SWITCH****REMOVAL**

- (1) Disconnect and isolate the battery negative remote cable.
- (2) Remove the upper steering column shroud. Refer to Steering Column Shroud Removal and Installation in this section.
- (3) Remove multi-function switch mounting screws (Fig. 7).

**Fig. 7 Multi-Function Switch Mounting**

- 1 - MOUNTING SCREWS

- (4) Disconnect wire connectors. Lift the switch straight up to remove.

**INSTALLATION**

For installation, reverse the above procedures.

- (1) Tighten multi-function switch to column retaining screws to 2.3 N·m (20 in. lbs.) torque.



**REMOVAL AND INSTALLATION (Continued)**

(2) Tighten steering column cover retaining screws to 2 N·m (17 in. lbs.) torque.

**STEERING COLUMN SHROUDS**

**REMOVAL**

- (1) Remove three lower shroud attaching screws.
- (2) Remove five knee bolster mounting screws and remove bolster.
- (3) Remove upper and lower shroud.
- (4) If removing the upper half only:

- (a) Remove lower shroud attaching screws.
- (b) Loosen the lower part of instrument cluster hood for clearance as necessary.
- (c) Remove upper shroud.

**INSTALLATION**

- (1) For installation, reverse the above procedures.
- (2) Tighten steering column shroud retaining screws to 2 N·m (17 in. lbs.) torque.



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# WINDSHIELD WIPERS AND WASHERS

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## DESCRIPTION AND OPERATION

### MULTI-FUNCTION SWITCH

**WARNING: VEHICLES ARE EQUIPPED WITH AN AIRBAG, REFER TO GROUP 8M, PASSIVE RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN SERVICE PROCEDURES.**

### DESCRIPTION

The multi-function switch contains:

- Turn signals
- Hazard warning
- Headlamps
- Headlamp beam select
- Parking lamps
- Panel dimmer
- Fog Lamp
- Headlamp optical horn
- Windshield wiper
- Pulse wipe
- Mist wipe
- Windshield washer switches.

The multi-function switch is mounted center of the steering column. There are two levers, one on each side of the steering column.

### OPERATION

The left side controls the signaling and lighting. The right side controls the windshield wiper and

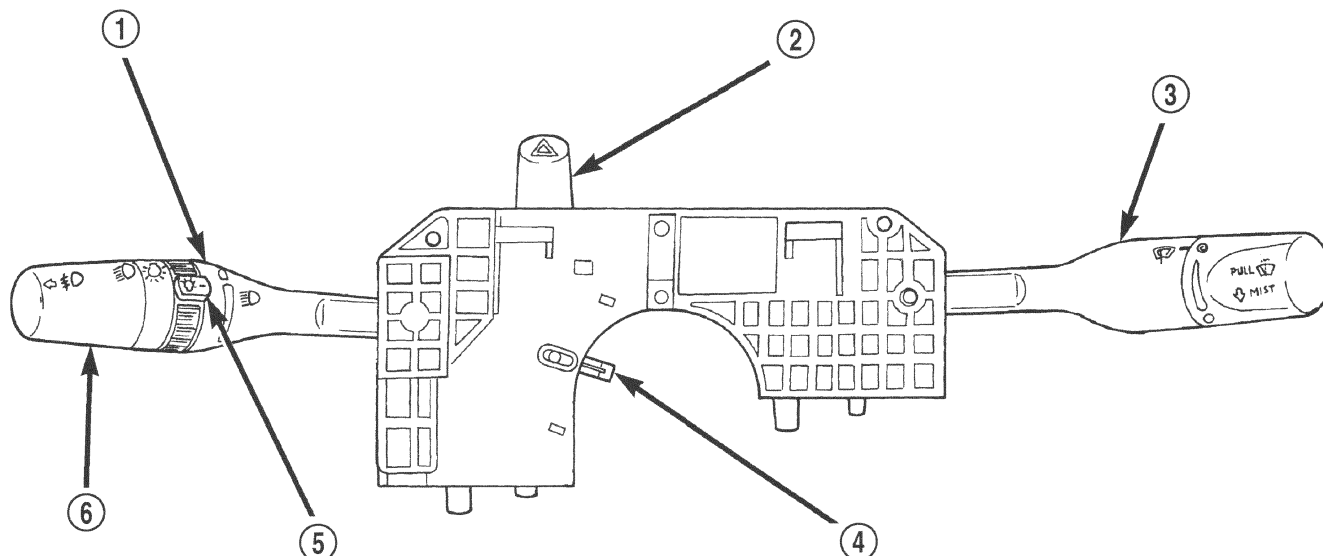
washer system. To use the washers pull lever toward the driver. The mist is a single wipe operation by pushing lever down and releasing the lever. Intermittent wiper operation is controlled by the Body Control Module (BCM). The lever has a selection of delay intervals and by turning the lever the wiper will cycle every half second to 36 seconds depending ON the vehicle's speed. The wiper has two cycle two speeds.

The windshield wipers will only operate when the ignition switch is in the ACCESSORY or IGNITION RUN position. Fuse 15, located in the Junction Block, fuses 8 and 14 in the Power Distribution Center (PDC) block, protects the wiper/washer system circuitry. The wiper motor also has an internal non-serviceable circuit breaker to provide protection against motor stall conditions.

The wiper and washer motors have magnetic fields created by internal permanent magnet. Electric power applied to the motor armature, located in the magnetic field, causes the motor to turn.

The wiper system internal operation uses the low speed motor circuit in combination with intermittent wipe relay. The washer pump motor has one internal circuit and therefore operates at one speed.

The wiper and washer system switch located on the steering column selects the mode of operation of the motors. The switch provides input to the BCM, which in turn operates the two relays. The intermittent wipe relay turns the wiper ON and OFF. The

**DESCRIPTION AND OPERATION (Continued)**

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**Fig. 1 Multi-Function/Windshield Wiper and Washer Switch**

- 1 - TURN SIGNAL CONTROL STALK
- 2 - HAZARD WARNING BUTTON
- 3 - WINDSHIELD WIPER/WASHER CONTROL

- 4 - CANCELING ACTUATOR
- 5 - PANEL DIMMER SWITCH
- 6 - EXTERIOR LIGHTING CONTROL

other changes the HIGH/LOW speeds. The switch also provides power to the washer pump motor.

The intermittent wiper system, in addition to low and high speed, has a delay mode. The delay mode has a range of 1/2 to 18 seconds when the vehicle speed is over 10 m.p.h.. The wiper delay times will automatically double to a range of 1 to 36 seconds when the vehicle speed is less than 10 m.p.h.. The delay is controlled by a variable resistor in the wiper switch and BCM.

The wiper motor and washer motor are designed to reduce radio frequency interference and provide electro-magnetic compatibility (RFI/EMC) in the vehicle environment. This is done with suppression circuits designed into the motors.

The wiper system completes the wipe cycle when the switch is turned OFF. The blades park in the lowest portion of the wipe pattern.

When using a scan tool (DRB) refer to the Body Diagnostic Manual for the procedures.

**WINDSHIELD WASHERS****DESCRIPTION**

All models are equipped with electric operated windshield washer pumps. The wash function can be accessed in the OFF or ON position of the multi-function wiper control switch.

**OPERATION**

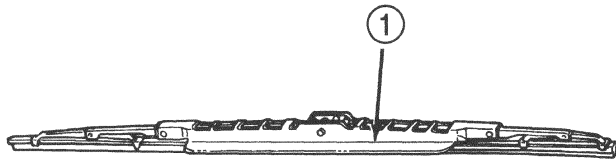
Pulling the lever towards the driver when the wiper switch is in the OFF position will operate the wipers and washer motor pump continuously until the lever is released. Releasing the lever will stop the washer pump but the wipers will complete the current wipe cycle. Followed by an average of two more wipe cycles ( $\pm 1$ ) before the wipers park and the module turns off.

The electric pump assembly is mounted with a grommet directly to the reservoir. Fluid is gravity fed from the reservoir to the motor. The fluid is forced by the pump through hoses to the hood mounted nozzles which direct the fluid streams to the windshield. The nozzles have one-way check valves located in the nozzle assemblies. The purpose of the check valves is to improve fluid flow response time and to prevent excessive washer fluid staining the surface of the hood. The hood mounted nozzles evenly distribute washer fluid across the surface of the windshield. The nozzles are not adjustable. The pump and reservoir are serviced as separate assemblies.

**WIPER BLADES****DESCRIPTION**

The wiper blades are a rubber element with a steel vertebrae that are mounted on the end of the windshield wiper arm and sweep across the front windshield to clear it of water, snow, and debris.



**DESCRIPTION AND OPERATION (Continued)**

958K-1

**Fig. 2 Wiper Blade-Typical**

1 - AIR FOIL

**OPERATION**

When the wiper blade rubber element is exposed to the weather for a long period of time, it tends to lose wiping ability. Periodic cleaning of the wiper blade element is suggested to remove the accumulation of salt and road film. The wiper blades, arms, and windshield should be cleaned with a sponge or cloth

and a mild detergent or non-abrasive cleaner. If the blades continue to streak or smear, they should be replaced. The driver and the passenger blade elements are 550 mm in length.

**DIAGNOSIS AND TESTING****MULTI-FUNCTION SWITCH – WINDSHIELD WIPER**

To test the multi-function windshield wiper switch, refer to Group 8J Turn Signals and Hazard Warning Flashers, for diagnosis and testing of the Multi-Function Switch.

**WINDSHIELD WASHERS**

Whenever a windshield washer malfunction occurs, first verify that the windshield washer wire harness is properly connected to all connectors before starting normal diagnosis and repair procedures. Refer to Windshield Washer Test table.

**WINDSHIELD WASHER TEST**

CONDITION	POSSIBLE CAUSE	CORRECTION
PUMP RUNS NO FLUID FLOWING.	1. NO FLUID IN THE RESERVOIR. 2. NOZZLE PLUGGED OR FROZEN. 3. BROKEN, LOOSE OR PINCHED HOSE. 4. FAULTY PUMP.	1. FILL RESERVOIR. 2. THAW AND CHECK FLOW IF BLOCKED 3. CHECK FLOW THROUGH HOSE CONNECTIONS. 4. APPLY BATTERY VOLTAGE TO MOTOR TERMINALS, REPLACE IF PUMP DOES NOT RUN.
SYSTEM OPERATES INTERMITTENTLY.	1. LOOSE WIRE CONNECTION. 2. FAULTY SWITCH.	1. CHECK WIRE CONNECTIONS. 2. DISCONNECT WIRE HARNESS USE VOLTMETER TO CHECK SWITCH.
SYSTEM OUTPUT IS LOW.	1. PINCHED HOSE. 2. HOSE BLOCKED.	1. CHECK FLOW THROUGH HOSE CONNECTION. 2. DISCONNECT HOSE AT NOZZLE AND Y CONNECTOR CHECK FOR FLOW. REPLACE ASS NECESSARY.

**WINDSHIELD WIPER SYSTEM CONDITIONS**

The following is a list of general wiper motor system problems and tests that are to be performed to locate the faulty part, and the corrective action to be taken. These tests will cover both two speed and intermittent wiper functions.

Actuation of the wiper relays can be performed using ACTUATOR TESTS on the DRB III. Status of the wiper park switch can also be monitored.

**MOTOR WILL NOT RUN IN ANY SWITCH POSITION**

(1) Check fuse 15, in the Junction Block and fuse 8 and 18 in the Power Distribution Center (Fig. 3) and

(Fig. 4). Refer to Group 8W, Wiring Diagrams for pin call outs.

(a) If fuse(s) are OK, go to Step 2.

(b) If fuse(s) are defective, replace and check motor operation in all switch positions.

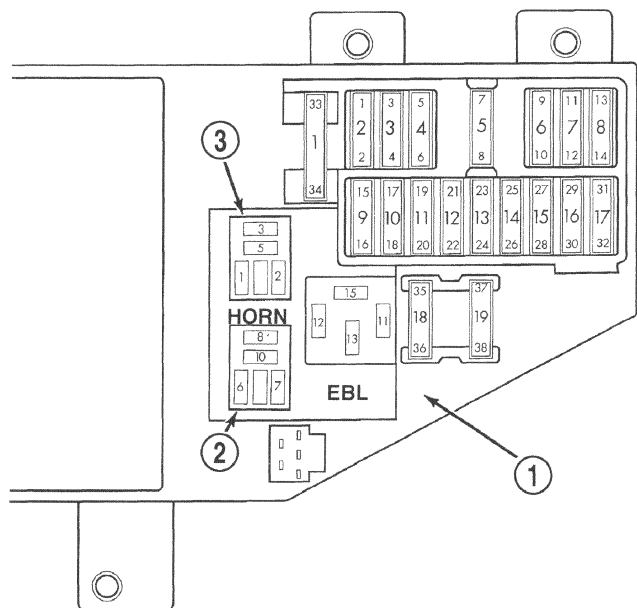
(c) If motor is still inoperative and the fuse does not blow, go to Step 2.

(d) If replacement fuse blows, go to Step 11.

(2) Disconnect motor wire harness connector.

(3) Check the wiper motor low speed. Using two jumper wires, connect one jumper wire between the battery positive jump start terminal and Pin B on the wiper motor connector (Fig. 5). Connect the other jumper wire to ground and Pin C on the wiper motor

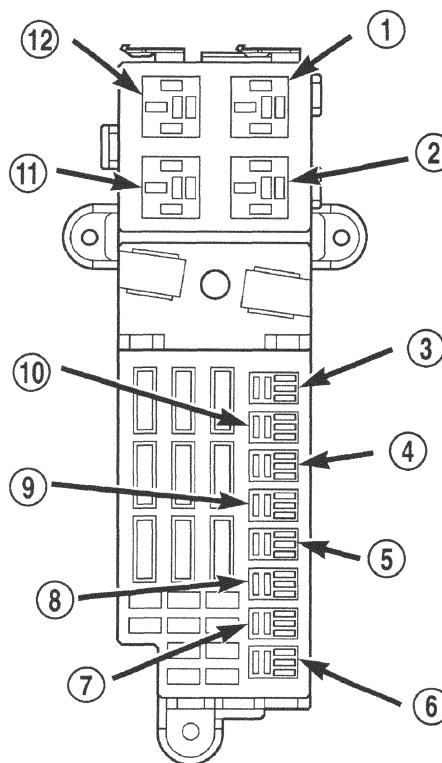
## DIAGNOSIS AND TESTING (Continued)



958J-3

**Fig. 3 Junction Block**

- 1 - CIRCUIT BREAKERS
- 2 - HORN RELAY
- 3 - H/LP RELAY



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**Fig. 4 Power Distribution Center (PDC)**

- 1 - LOW SPEED RADIATOR FAN RELAY (11)
- 2 - ENGINE STARTER MOTOR RELAY (9)
- 3 - NOT USED (8)
- 4 - POWER TOP INHIBIT (6)
- 5 - HI/LO WIPER RELAY (4)
- 6 - NOT USED (1)
- 7 - TRANSMISSION CONTROL RELAY (2)
- 8 - FUEL PUMP RELAY (3)
- 9 - INTERMITTENT WIPER RELAY (5)
- 10 - A/C COMPRESSOR CLUTCH RELAY (7)
- 11 - AUTOMATIC SHUTDOWN RELAY (10)
- 12 - HIGH SPEED RADIATOR FAN RELAY (12)

connector. Check the wiper motor high speed, connect the positive jumper wire to Pin A on the wiper motor connector. Connect the negative jumper wire to Pin C on the wiper motor connector.

(a) If motor runs, go to Step 4.

(b) If motor does not run, high or low speed replace the wiper motor.

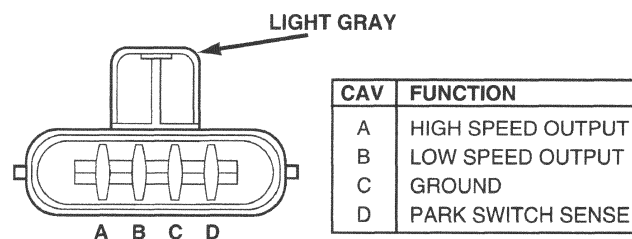
(4) Using a ohmmeter, check for good ground at Pin C of the wiper motor wire harness connector. If OK, replace motor. If not repair the ground circuit as necessary.

(5) The wiper switch in the ON position. Using an voltmeter, check for battery voltage at terminal 29 of the intermittent wiper relay in the Power Distribution Center. If no voltage check fuse 18 (Fig. 4). If OK, go to Step 6. If not repair as necessary.

(6) Using an ohmmeter, check from terminal 28 of the HI-LO wiper relay to Pin A of the motor wire connector for continuity. Check from terminal 11 of the HI-LO wiper relay to Pin B of the motor wire connector for continuity. If OK, go to Step 7. If not repair as necessary.

(7) Using an ohmmeter, check for continuity between the HI-LO wiper relay and the intermittent wiper relay. Check from terminal 36 of the HI- LO wiper relay to terminal 37 of the intermittent wiper relay. If OK, check for faulty relays. If not repair as necessary.

(8) Disconnect the J3 14-way connector from the BCM (Fig. 6).

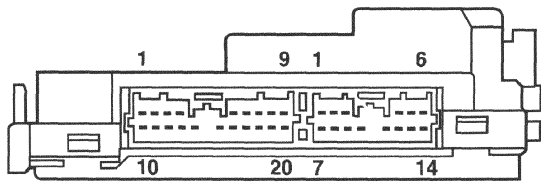
**WINDSHIELD WIPER MOTOR**

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**Fig. 5 Motor Wire Connector**

(9) Using an ohmmeter, check for continuity from terminal 7 of the J3 14-way connector to the terminal 15 of the intermittent wiper relay. If OK, go to Step 10. If not repair as necessary.

## DIAGNOSIS AND TESTING (Continued)



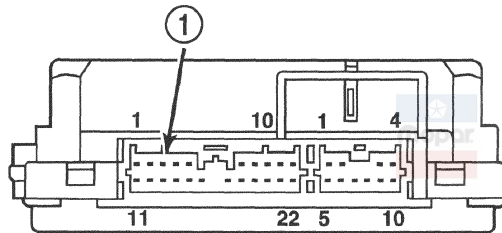
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**Fig. 6 Body Control Module 14-Way Connector**

(10) Using a voltmeter, connect positive lead to terminal 10 of the BCM J1 22-way connector and negative lead to ground (Fig. 7). Turn ignition switch to the ON position. Slowly move the wiper switch from OFF position through each position to HIGH.

(a) If voltage increases from zero to approximately 10 volts in the HIGH position, replace BCM. If no voltage, go to Step b.

(b) Using an ohmmeter, check for continuity from terminal 2 of wiper switch connector to terminal 10 of the BCM J3 22-way connector. If no continuity, repair circuit. If OK, go to Step 11.



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**Fig. 7 Body Control Module 22-Way Connector**

1 - WHITE CONNECTOR

(11) Disconnect motor connector and replace fuse 15 from the Junction Block.

(a) If fuse does not blow, go to Step 2.

(b) If fuse blows, wiper control circuit is at fault, repair as necessary, refer to Group 8W, Wiring Diagrams.

### MOTOR RUNS SLOWLY AT ALL SPEEDS

(1) Disconnect the wire harness from the wiper motor. Remove wiper arms and blades. Disconnect motor drive link from motor. Connect an ammeter between battery negative jump start terminal and Pin C on the wiper motor connector (Fig. 5). Connect battery positive wire to Pin B on the wiper motor connector. When replacing drive link nut tighten to 11 to 12 N·m (98 to 106 in. lbs.) torque.

(a) If average ammeter reading is more than 6 amps, replace motor.

(b) If motor runs and average ammeter reading is less than 6 amps, go to Step 2.

(2) Check to see if wiper linkage or pivots are binding or caught.

### MOTOR WILL RUN AT HIGH SPEED, BUT NOT MOVE AT LOW SPEED. MOTOR WILL RUN AT LOW SPEED, BUT WILL NOT MOVE AT HIGH SPEED

(1) Disconnect motor connector.

(2) If motor will not run on low speed, connect a jumper wire between battery positive jump start terminal and Pin B on the wiper motor connector. Connect a second jumper wire between ground and Pin C on the wiper motor connector (Fig. 5).

(a) If motor runs, go to Step 3.

(b) If motor does not run, replace the motor.

(3) If motor will not run on high speed, connect a jumper wire between battery positive remote cable terminal and Pin A. Connect a second jumper wire between ground and Pin C of the motor connector.

(a) If motor runs, go to Step 4.

(b) If motor does not run, replace the motor.

(4) If wipers will not run at low speed, using an ohmmeter, check for open circuit. Check between terminal 11 of the HI-LO wiper relay to Pin B of the wiper motor wire harness connector for continuity. If OK, go to Step 5. If not repair as necessary.

(5) If wiper will not run at the high speed, using an ohmmeter, check for an open circuit. Check between terminal 28 of the HI-LO wiper relay and Pin A of the wiper motor wire harness connector for continuity. If OK, go to Step 6. If not repair as necessary.

(6) Check for faulty HI-LO wiper relay.

### WIPERS RUN AT HIGH SPEED WITH SWITCH IN LOW SPEED POSITION. WIPERS OPERATE IN INTERMITTENT MODE, BUT EACH WIPE IS AT HIGH SPEED.

(1) Disconnect motor connector.

(2) Using two jumper wires, connect one between the battery positive jump start terminal and Pin B on the wiper motor connector. Connect the second lead between ground and Pin C on the wiper motor connector (Fig. 5). If motor runs at low speed, go to Step 3. If motor runs at high speed, replace the motor.

(3) Check for faulty HI-LO wiper relay. Check for crossed wires in harness from HI-LO relay to motor.

(4) Disconnect J3 14-way connector from the BCM and remove the intermittent wiper relay.

(5) Using an ohmmeter, check for short to ground Pin 8 of the J3 14-way connector.

(6) If continuity to ground is present, repair as necessary. If no continuity to ground, replace the BCM.



**DIAGNOSIS AND TESTING (Continued)****WIPERS RUN AT LOW SPEED WITH SWITCH IN HIGH SPEED POSITION**

- (1) Check for faulty HI-LO wiper relay.
- (2) Using an ohmmeter, check for open circuit between terminal 12 of the HI-LO wiper relay and terminal 8 of the BCM J3 14-way connector. If OK, go to Step 3. If not OK, repair as necessary.
- (3) Check wiper switch.
- (4) Check for binding linkage
- (5) Refer to MOTOR RUNS SLOWLY AT ALL SPEEDS.

**MOTOR WILL KEEP RUNNING WITH SWITCH IN OFF POSITION.**

Using a ohmmeter, Check Pin 8 of the BCM J3 14-way connector for continuity to ground signal when the wipers are in the park position only.

- (1) If no ground signal, test wiper motor.
- (2) If a ground is received test the multi-function switch.
- (3) If the multi-function switch test OK, replace the BCM.

**WIPER WILL RUN CONTINUOUSLY WITH SWITCH IN THE INTERMITTENT POSITION. WHEN COLUMN SWITCH IS TURNED OFF, WIPERS STOP WHEREVER THEY ARE, WITHOUT RETURNING TO PARK POSITION.**

- (1) Using an ohmmeter, check for ground at Pin D on the wiper motor connector. If grounded, replace motor.
- (2) Using an ohmmeter, with the wiper motor in the PARK position, check for continuity between Pin C and Pin D on the wiper motor connector. If continuous continuity, go to Step 3. If not OK, replace motor.
- (3) Disconnect the wiper motor wire harness connector and the J3 14-way connector. Check for continuity between Pin D of the wiper motor wire harness connector and terminal 2 of J3 14-way connector of the BCM. If no continuity, repair as necessary. If continuity is OK, test the wiper motor.

**WIPERS DO NOT RUN WHEN WASHER MOTOR IS ENGAGED**

- (1) Backprobe the J3 14-way connector from the BCM. Refer to Group 8E-Instrument Panel and Systems to access.
- (2) Using a voltmeter, connect positive lead to terminal 10 of the 14-way connector and the negative lead to ground.
- (3) Engage the washer switch so that the washer motor runs continuously.
  - (a) If the voltage is zero, check the wiring between the washer motor and the BCM. Repair as necessary.
  - (b) If the battery voltage, ensure that the 14-way connector is disconnected and check Pin 10 if it has 12 volts. If no voltage replace the BCM. If battery voltage, test for a wiring short refer to Group 8W, Wiring Diagrams.

**NOTE: Make sure to test the multi-function switch before replacing the BCM.**

**WIPERS OPERATE IN INTERMITTENT SETTINGS BUT DOES NOT HAVE SIX DIFFERENT SPEEDS.**

To test the multi-function windshield wiper switch, refer to Group 8J, Turn Signals and Hazard Warning Flashers, for diagnosis and testing of the Multi-Function Switch.

**WIPER MOTOR SYSTEM**

**WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, SEE GROUP 8M, RESTRAINT SYSTEMS FOR STEERING WHEEL OR COLUMN REMOVAL PROCEDURES.**

Whenever a wiper motor malfunction occurs, disconnect motor wire harness and clean the terminals. Ensure the wire harness is properly connected before starting diagnosis and repair procedures. Refer to Wiper Motor Test table.

**DIAGNOSIS AND TESTING (Continued)****WIPER MOTOR TEST**

CONDITION	POSSIBLE CAUSES	CORRECTION
WIPER BLADES DO NOT PARK PROPERLY	1) WIPER ARMS IMPROPERLY PARKED. 2) WIPER ARMS ARE LOOSE ON PIVOT SHAFT. 3) MOTOR CRANK LOOSE AT OUTPUT SHAFT.	1) REMOVE WIPER ARMS AND RUN WIPER MOTOR TO PARK POSITION. REFER TO WIPER ARM REPLACEMENT 2) REMOVE WIPER ARM AND RUN WIPER MOTOR TO PARK POSITION. REFER TO WIPER ARM REPLACEMENT. 3) REMOVE WIPER ARM. RUN WIPER MOTOR TO PARK POSITION AND REMOVE THE MODULE. WITHOUT ROTATING THE MOTOR OUTPUT SHAFT, REMOVE THE CRANK AND CLEAN THE MOTOR SHAFT OF METAL FITTINGS. MOUNT THE MOTOR CRANK ON THE MOTOR SHAFT TOWARD THE MOTOR SO IT CAN SLIDE WITH THE LINKAGE IN THE FULL REVERSAL POSITION. TORQUE TO 25-35 Nm (18-23 ft.. lbs.), WITHOUT ROTATING THE MOTOR OUTPUT SHAFT. INSTALL WIPER SYSTEM, REFER TO WIPER MODULE REPLACEMENT.
MOTOR STOPS IN ANY POSITION WHEN THE SWITCH IS TURNED OFF	1) OPEN PARK CIRCUIT.	1) CHECK PARK SWITCH BY DISCONNECTING WIRE CONNECTOR AND APPLY BATTERY VOLTAGE TO PIN A. PLACE A JUMPER WIRE FROM PIN B TO PIN C, THEN TO AN EXTERNAL GROUND. REPLACE MOTOR IF IT DOES NOT PARK.
MOTOR WILL NOT STOP WHEN SWITCH IS TURNED OFF	1) FAULTY SWITCH. 2) FAULTY RELAY.	1) CHECK SWITCH IN LOW, HIGH, AND INTERMITTANT POSITION. REPLACE IF NECESSARY. PARK SWITCH MAY BE SHORTED TO GROUND.
WIPER BLADES SLAP AGAINST COWL SCREEN OR WINDOW MOLDINGS	1) WIPER ARMS ARE PARKED INCORRECTLY.	1) REPAIR WIPER ARMS. REFER TO WIPER ARM REPLACEMENT.
BLADES CHATTER	1) FOREIGN SUBSTANCE SUCH AS POLISH ON GLASS OR BLADES. 2) ARMS TWISTED, BLADE AT WRONG ANGLE ON GLASS. 3) BLADE STRUCTURE BENT. 4) BLADE ELEMENT HAS PERMANENT SET.	1) CLEAN GLASS AND BLADE ELEMENT WITH NON-ABRASIVE CLEANER. 2) REPLACE ARM. 3) REPLACE BLADE. 4) REPLACE BLADE ELEMENT.
WIPER KNOCK AT REVERSAL	1) LINKAGE BUSHINGS WORN. 2) ARMATURE ENDPLAY IN MOTOR.	1) REPLACE WORN LINK. REFER TO WIPER LINKAGE REMOVAL. 2) REPLACE WIPER MOTOR. REFER TO WIPER MOTOR REPLACEMENT.
WIPER MOTOR WILL NOT RUN	1) BLOWN FUSE. 2) NEW FUSE BLOWS AGAIN. 3) NEW FUSE BLOWS AGAIN. 4) NO VOLTAGE AT MOTOR. 5) POOR GROUND.	1) REPLACE FUSE, RUN SYSTEM. 2) CHECK FOR SHORT IN WIRING OR SWITCH. 3) REPLACE FUSE, REMOVE MOTOR CONNECTOR, TURN SWITCH ON, FUSE DOES NOT BLOW, REPLACE MOTOR. 4) CHECK SWITCH AND WIRING. 5) CLEAN GROUND WIRE CONNECTION FROM CORROSION.

## REMOVAL AND INSTALLATION

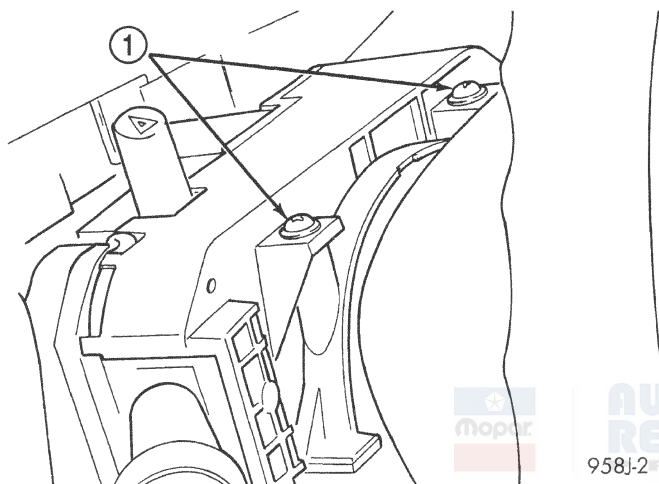
### MULTI-FUNCTION SWITCH

#### REMOVAL

(1) Disconnect and isolate the battery negative remote cable.

(2) Remove the upper steering column shroud. Refer to Steering Column Shroud Removal and Installation in this section.

(3) Remove multi-function switch mounting screws (Fig. 8).



**Fig. 8 Multi-Function Switch Mounting**

1 - MOUNTING SCREWS

(4) Disconnect wire connectors. Lift the switch straight up to remove.

#### INSTALLATION

For installation, reverse the above procedures.

(1) Tighten multi-function switch to column retaining screws to 2.3 N·m (20 in. lbs.) torque.

(2) Tighten steering column cover retaining screws to 2 N·m (17 in. lbs.) torque.

### STEERING COLUMN SHROUDS

#### REMOVAL

(1) Remove three lower shroud attaching screws.

(2) Remove five knee bolster mounting screws and remove bolster.

(3) Remove upper and lower shroud.

(4) If removing the upper half only:

(a) Remove lower shroud attaching screws.

(b) Loosen the lower part of instrument cluster hood for clearance as necessary.

(c) Remove upper shroud.

#### INSTALLATION

(1) For installation, reverse the above procedures.

(2) Tighten steering column shroud retaining screws to 2 N·m (17 in. lbs.) torque.

### WASHER NOZZLE

#### REMOVAL

To replace nozzle, disconnect washer fluid hose. Using needle nose pliers, squeeze together the locking tabs on the nozzle and remove.

#### INSTALLATION

For installing make sure that both locking tabs are securely snapped into position. Connect washer fluid hose. If no washer spray, check fluid hoses for kinks or leaks.

### WASHER RESERVOIR

#### REMOVAL

(1) Disconnect and isolate the battery negative remote cable.

(2) Disconnect washer fluid hose at in-line connector on top of the right shock tower.

(3) Partially remove bumper fascia as needed to gain access to the reservoir. Refer to Group 23, Body.

(4) Disconnect wire connector from washer pump and harness mounting tab (Fig. 9).

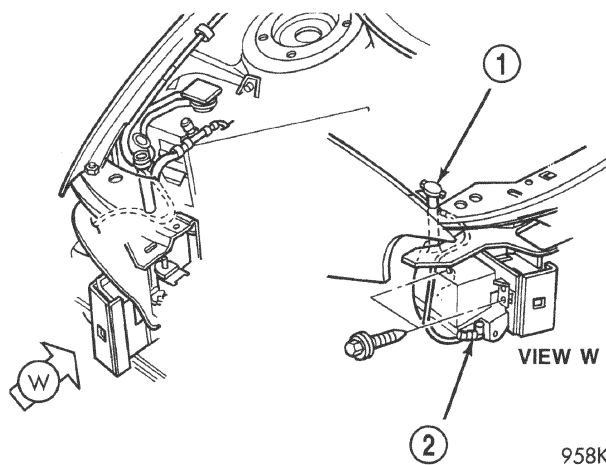
(5) Slide rearward and drop down and away from vehicle.

(6) Drain washer fluid from reservoir into an appropriate container.

(7) Disconnect the washer hose from the reservoir.

#### INSTALLATION

For installation, reverse the above procedures.



**Fig. 9 Reservoir Removal**

1 - RESERVOIR  
2 - WASHER PUMP

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## REMOVAL AND INSTALLATION (Continued)

### WASHER RESERVOIR PUMP

#### REMOVAL

- (1) Disconnect and isolate the battery negative remote cable.
- (2) Partially remove the bumper fascia as needed to gain access to the reservoir pump. Refer to Group 23, Body.
- (3) Place a drain bucket below the reservoir to catch any washer solvent that may leak out.
- (4) Firmly grasping pump by hand twist and pull away from reservoir and out of grommet. Care must be taken not to puncture reservoir.
- (5) Remove rubber grommet from reservoir and throw away.

#### INSTALLATION

For installation, reverse the above procedures. A new grommet is required for installation. Refill reservoir with the washer solvent.

### WIPER ARM AND BLADE

#### REMOVAL

- (1) Place the wiper arm/blades in the PARK position and turn ignition OFF.
- (2) Unsnap arm cover. By hand rock gently side to side and slide away from arm pivot. To remove the left side raise hood for clearance.
- (3) Loosen retention nut.
- (4) Remove the arm from the pivot by using a universal claw puller or by hand rock gently side to side and slide. Raise blade and arm off glass and rock side to side while applying pressure with the puller till loose. Ensure that the puller is not on the collar below the arm.
- (5) Remove arm retention nut and arm.

#### INSTALLATION

- (1) Place arm on pivot shaft, align blade with wiper location made on windshield.
- (2) Start retention nut.
- (3) Raise arm and blade off windshield while tightening retention nut. Tighten nut to 33 to 40 N·mm (23 to 29 ft. lbs.).
- (4) Install arm head cover.

### WIPER BLADE

#### REMOVAL

- (1) Turn wiper switch ON, position blades to a convenient place on the windshield by turning the ignition switch ON and OFF. Turn ignition switch OFF, when blade is in the desirable position.
- (2) Lift wiper arm to raise blade off glass.

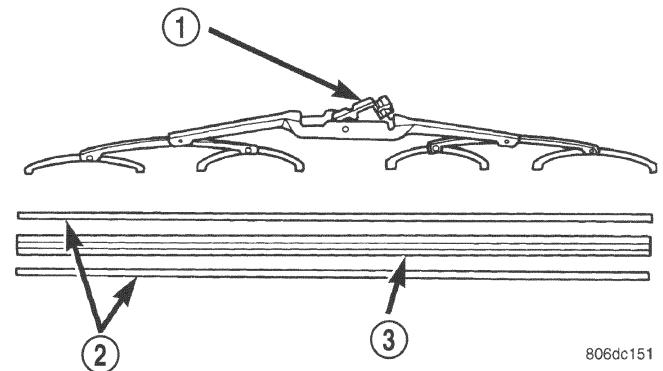
(3) Remove blade assembly from arm by pushing release tab under arm tip and slide blade away from arm tip (Fig. 10) and (Fig. 11).

(4) The driver's side wiper blade has an air foil on it and the air foil points downward as in (Fig. 2).

(5) Gently place wiper arm tip on windshield.

#### INSTALLATION

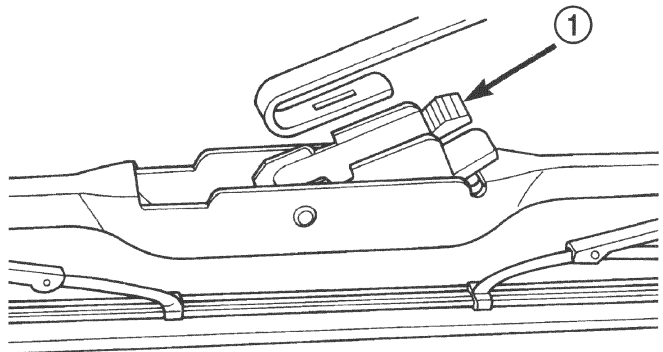
For installation reverse the above procedures. When complete turn ignition switch ON. Turn wiper switch OFF allowing the wiper blades PARK, then turn ignition switch OFF.



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**Fig. 10 Wiper Blade and Element**

- 1 - ARM RELEASE TAB
- 2 - VERTEBRA
- 3 - RUBBER ELEMENT



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**Fig. 11 Remove Blade from Arm**

- 1 - RELEASE TAB

### WIPER BLADE ELEMENT

#### REMOVAL

- (1) Lift wiper arm to raise blade off the windshield.
- (2) Remove blade assembly from arm by pushing release tab under arm tip and slide blade away from arm tip (Fig. 10) and (Fig. 11). Gently place wiper arm tip on windshield.

**REMOVAL AND INSTALLATION (Continued)**

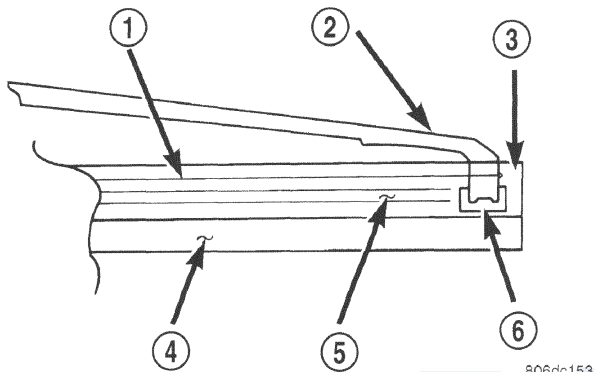
(3) Remove wiping rubber element by pulling stopper of the rubber element, out of the claws of blade assembly (Fig. 12). The wiper rubber element and two vertebra will be removed.

**INSTALLATION**

(1) Slide the rubber element into the blade assembly through the claws.

(2) Slide the metal vertebra into the top element slot, with the vertebra curved to match the windshield.

(3) Ensure that the final blade claw is locked into the slot at the end of the rubber element (Fig. 12).

**Fig. 12 Wiper Blade and Element**

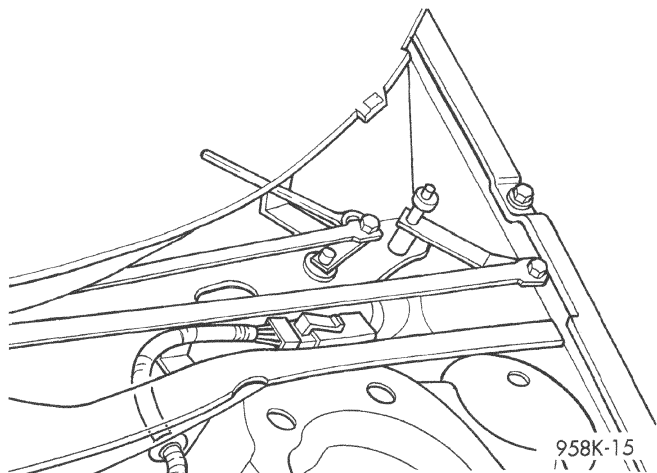
- 1 - VERTEBRA
- 2 - CLAW
- 3 - TO GRASP AND PULL
- 4 - RUBBER ELEMENT
- 5 - CHANNEL
- 6 - SLOT

**WIPER ARM LINKAGE OR CAP****REMOVAL**

- (1) Remove wiper arms and blades.
- (2) Remove the cowl screen.
- (3) Remove wiper motor assembly.
- (4) Disconnect wiper arm linkage, by using a ball joint/tie rod separator, separate the right and left ball cap from the ball (Fig. 13).
- (5) Disconnect drive link from the motor crank. Using a ball joint/tie rod separator and separate the ball cap from the ball.

**INSTALLATION**

For installation, reverse the above procedures. Align link ball cap over ball and gently press fit against shoulder of cap to lock cap into position. If motor output crank nut was removed, tighten nut to 25 to 30 N·m (19 to 23 ft. lbs.).

**Fig. 13 Linkage Removal****WIPER MOTOR****REMOVAL**

(1) Remove wiper motor assembly. Refer to Wiper Motor Assembly Removal and Installation in this section.

(2) With motor assembly on bench, disconnect drive linkage from motor output crank. Using a ball joint/tie rod separator, separate the ball cap from the ball (Fig. 13).

(3) Remove retainering nut to motor output crank and remove crank from motor output shaft.

(4) Remove motor mounting nuts and remove motor.

**INSTALLATION**

For installation, reverse the above procedures. Tighten the mounting screws to 10 to 12 N·m (89 to 106 in. lbs.) torque. Ensure that the motor connector seal is properly positioned. Tighten the motor mounting nuts to 25 to 30 N·m (19 to 23 ft. lbs.) torque.

**WIPER MOTOR ASSEMBLY****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable.

(2) Remove wiper arms and blades (Fig. 14).

(3) Remove the cowl screen.

(4) Remove the four wiper motor assembly mounting screws then lift assembly to gain access to wire harness clip.

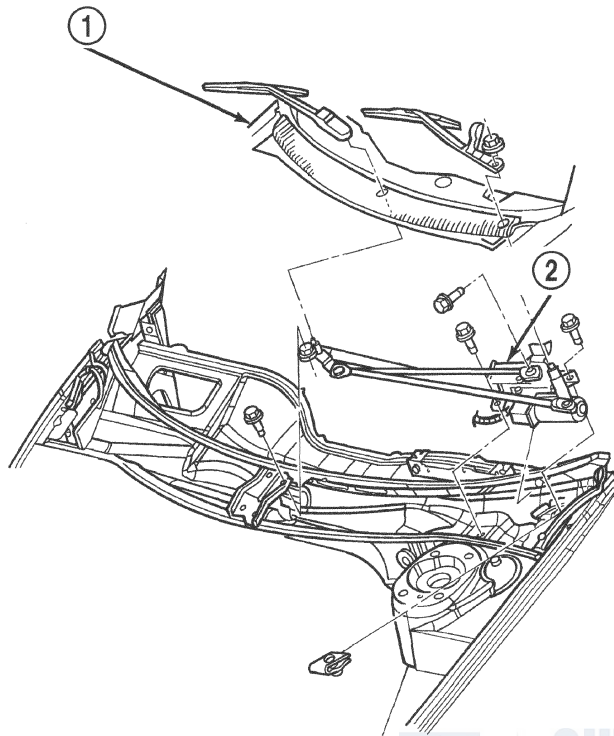
(5) Disconnect harness clip from the forward mounting leg.

(6) Disconnect wire connector at motor and remove assembly.

**INSTALLATION**

For installation, reverse the above procedures. Tighten the mounting screws to 10 to 12 N·m (89 to 106 in. lbs.) torque. Ensure that the motor connector seal is properly positioned.

## REMOVAL AND INSTALLATION (Continued)



**Fig. 14 Wiper Motor Assembly**

- 1 - COWL SCREEN  
2 - WIPER MOTOR ASSEMBLY

## WIPER MOTOR ASSEMBLY MOUNTING GROMMET

### REMOVAL

(1) Remove wiper motor assembly. Refer to Wiper Motor Assembly Removal and Installation in this section.

(2) Remove the four grommets.

### INSTALLATION

For installation, reverse the above procedures. Ensure proper position of grommets when installing:

- (1) The right inboard grommet is installed with insert flat facing down. The remaining grommets installed with insert flat facing up.
- (2) The left outboard grommet has a small eyelet.
- (3) The right inboard grommet threaded eyelet.
- (4) The two center grommets have a large eyelets

## CLEANING AND INSPECTION

### WIPER BLADES

Wiper blades exposed to the weather for a long period of time tend to lose their wiping effectiveness.

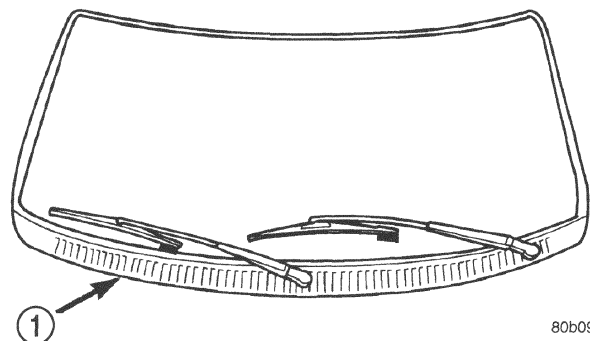
Periodic cleaning of the wiper blade is recommended to remove the accumulation of salt and road grime. The wiper blades, arms and windshield should be cleaned with a sponge or cloth and a mild detergent or nonabrasive cleaner. If the wiper blades continue to streak or smear, they should be replaced. The wiper blade should run smoothly across the windshield in both directions. The wiper blade should slightly roll over center when the blade reverses direction. A wiper blade insert that has lost flexibility or a wiper arm that has lost spring tension, will cause the blade to skip or chatter across the windshield. If the wiper blades are new and the wiper arm spring tension is OK and a chattering sound is emitted from the wiper(s), the wiper blade is not rolling over center. If this condition exists, refer to the Wiper Arm Alignment paragraph of this group.

## ADJUSTMENTS

### WIPER ARM

High speed, wet windshield operation, the right blade tip may override the cowl screen slightly. This is normal and should not affect wiper system performance.

- (1) Lift arms and blade assemble to a over centered position.
- (2) Turn ignition switch to ON or ACC position.
- (3) Use LOW speed setting and cycle the wiper motor to the PARK position.
- (4) Turn ignition OFF.
- (5) Carefully lower arm and blades to the windshield.
- (6) Measure the distance from the blade tip to the cowl screen edge. The blade should be 18 to 42 mm (.75 to 1.60 ins.).
- (7) If not OK, check for worn parts.
- (8) In the event the blade tip strikes the cowl screen or molding remove arm. Position arm on windshield and tighten to 33 to 40 N·m (23 to 29 ft. lbs.) torque (Fig. 15).



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**Fig. 15 Arm Adjustment**

- 1 - COWL SCREEN



LAMPS

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LIGHTING DIAGNOSIS

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DESCRIPTION AND OPERATION

DIAGNOSTIC PROCEDURES

DESCRIPTION

JX vehicles use lighting on the interior and exterior of the vehicle for illuminating and indicating purposes. Lighting circuits are protected by fuses or circuit breakers. Lighting circuits require an overload protected power source, on/off device, lamps and body ground to operate properly. Plastic lamps require a wire in the harness to supply body ground to the lamp socket. Lamp sockets that are exposed to moisture should be coated with Mopar® Multi-purpose Grease, or equivalent, to avoid corrosion. If a socket has become corroded, clean socket and bulb base with abrasive fiber sanding pad or metallic bristle brush. Replace sockets and bulbs that are deformed from corrosion that could prevent continuous body ground.

Wire connectors can make intermittent contact or become corroded. Before coupling wire connectors, inspect the terminals inside the connector. Male terminals should not be bent or disengaged from the insulator. Female terminals should not be sprung open or disengaged from the insulator. Bent and sprung terminals can be repaired using needle nose pliers and pick tool. Corroded terminals appear chalky or green. Corroded terminals should be replaced to avoid recurrence of the problem symptoms. Wire connector terminals should be coated with Mopar® Multi-purpose Grease, or equivalent, to avoid corrosion.

Begin electrical system failure diagnosis by testing related fuses and circuit breakers in the fuse block and engine compartment. Verify that bulbs are in good condition and test continuity of the circuit ground. Refer to Group 8W, Wiring Diagrams, for component location and circuit information.

SAFETY PRECAUTIONS

DESCRIPTION

**WARNING: EYE PROTECTION SHOULD BE USED WHEN SERVICING GLASS COMPONENTS. PERSONAL INJURY CAN RESULT.**

**CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result. Do not use bulbs with higher candle power than indicated in the Bulb Application table at the end of this group. Damage to lamp can result. Do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owners Manual.**

When it is necessary to remove components to service another, it should not be necessary to apply excessive force or bend a component to remove it. Before damaging a trim component, verify hidden fasteners or captured edges are not holding the component in place.

**DESCRIPTION AND OPERATION (Continued)****SYSTEM DIAGNOSTIC PROCEDURES****DESCRIPTION**

When a vehicle experiences problems with the headlamp system, verify the condition of the battery

connections, charging system, headlamp bulbs, wire connectors, relay, high beam dimmer switch and headlamp switch. Refer to Group 8W, Wiring Diagrams for component locations and circuit information.

**HEADLAMP DIAGNOSIS**

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF	<ol style="list-style-type: none"> <li>1. Loose or corroded battery cables.</li> <li>2. Loose or worn generator drive belt.</li> <li>3. Charging system output too low.</li> <li>4. Battery has insufficient charge.</li> <li>5. Battery is sulfated or shorted.</li> <li>6. Poor lighting circuit Z1-ground.</li> <li>7. Both headlamp bulbs defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean and secure battery cable clamps and posts.</li> <li>2. Adjust or replace generator drive belt.</li> <li>3. Test and repair charging system, refer to Group 8A,</li> <li>4. Test battery state-of -charge , refer to Group 8A.</li> <li>5. Load test battery, refer to Group 8A.</li> <li>6. Test for voltage drop across Z1-ground locations, refer to Group 8W.</li> <li>7. Replace both headlamp bulbs.</li> </ol>
HEADLAMP BULBS BURN OUT FREQUENTLY	<ol style="list-style-type: none"> <li>1. Charging system output too high.</li> <li>2. Missing or burned out fuse.</li> <li>3. Loose or corroded terminals or splices in circuit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Test and repair charging system, refer to Group 8A.</li> <li>2. Add or replace fuse.</li> <li>3. Inspect and repair all connectors and splices, refer to Group 8W.</li> </ol>
HEADLAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	<ol style="list-style-type: none"> <li>1. Charging system output too low.</li> <li>2. Poor lighting circuit Z1-ground.</li> <li>3. High resistance in headlamp circuit.</li> <li>4. Both headlamp bulbs defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. Test and repair charging system, refer to Group 8A.</li> <li>2. Test for voltage drop across Z1-ground locations, refer to Group 8W.</li> <li>3. Test amperage draw of headlamp circuit.</li> <li>4. Replace both headlamp bulbs.</li> </ol>
HEADLAMPS FLASH RANDOMLY	<ol style="list-style-type: none"> <li>1. Poor lighting circuit Z1-ground.</li> <li>2. High resistance in headlamp circuit.</li> <li>3. Faulty headlamps switch circuit breaker.</li> <li>4. Loose or corroded terminals or splices in circuit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Test for voltage drop across Z1-ground locations, refer to Group 8W.</li> <li>2. Test amperage draw of headlamp circuit.</li> <li>3. Replace headlamp switch.</li> <li>4. Inspect and repair all connectors and splices, refer to Group 8W.</li> </ol>
HEADLAMPS DO NOT ILLUMINATE	<ol style="list-style-type: none"> <li>1. No voltage to headlamps.</li> <li>2. No Z1-ground at headlamps.</li> <li>3. Faulty headlamp switch.</li> <li>4. Faulty headlamp dimmer (multi-function) switch.</li> <li>5. Broken connector terminal or wire splice in headlamp circuit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Repair open headlamp circuit, refer to Group 8W.</li> <li>2. Repair circuit ground, refer to Group 8W.</li> <li>3. Replace headlamp switch.</li> <li>4. Replace multi-function switch.</li> <li>5. Repair connector terminal or wire splice.</li> </ol>

**DESCRIPTION AND OPERATION (Continued)****FOG LAMP DIAGNOSIS**

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	<ol style="list-style-type: none"> <li>1. Loose or corroded battery cables.</li> <li>2. Loose or worn generator drive belt.</li> <li>3. Charging system output too low.</li> <li>4. Battery has insufficient charge.</li> <li>5. Battery is sulfated or shorted.</li> <li>6. Poor lighting circuit Z1-ground.</li> <li>7. Both fog lamp bulbs defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean and secure battery cable clamps and posts.</li> <li>2. Adjust or replace generator drive belt.</li> <li>3. Test and repair charging system, refer to Group 8A,</li> <li>4. Test battery state-of -charge, refer to Group 8A.</li> <li>5. Load test battery, refer to Group 8A.</li> <li>6. Test for voltage drop across Z1-ground locations, refer to Group 8W.</li> <li>7. Replace both fog lamp bulbs.</li> </ol>
FOG LAMP BULBS BURN OUT FREQUENTLY	<ol style="list-style-type: none"> <li>1. Charging system output too high.</li> <li>2. Loose or corroded terminals or splices in circuit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Test and repair charging system, refer to Group 8A.</li> <li>2. Inspect and repair all connectors and splices, refer to Group 8W.</li> </ol>
FOG LAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	<ol style="list-style-type: none"> <li>1. Charging system output too low.</li> <li>2. Poor lighting circuit Z1-ground.</li> <li>3. High resistance in fog lamp circuit.</li> <li>4. Both fog lamp bulbs defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. Test and repair charging system, refer to Group 8A.</li> <li>2. Test for voltage drop across Z1-ground locations, refer to Group 8W.</li> <li>3. Test amperage draw of fog lamp circuit.</li> <li>4. Replace both fog lamp bulbs.</li> </ol>
FOG LAMPS FLASH RANDOMLY	<ol style="list-style-type: none"> <li>1. Poor lighting circuit Z1-ground.</li> <li>2. High resistance in fog lamp circuit.</li> <li>3. Faulty fog lamp switch.</li> <li>4. Loose or corroded terminals or splices in circuit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Test for voltage drop across Z1-ground locations, refer to Group 8W.</li> <li>2. Test amperage draw of fog lamp circuit.</li> <li>3. Replace fog lamp switch.</li> <li>4. Inspect and repair all connectors and splices, refer to Group 8W.</li> </ol>
FOG LAMPS DO NOT ILLUMINATE	<ol style="list-style-type: none"> <li>1. Blown fuse for fog lamps.</li> <li>2. No Z1-ground at fog lamps.</li> <li>3. Faulty fog lamp switch.</li> <li>4. Broken connector terminal or wire splice in fog lamp circuit.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace fuse, refer to Group 8W.</li> <li>2. Repair circuit ground, refer to Group 8W.</li> <li>3. Replace fog lamp switch.</li> <li>4. Repair connector terminal or wire splice.</li> </ol>



# HEADLAMP AND FOG LAMP ALIGNMENT

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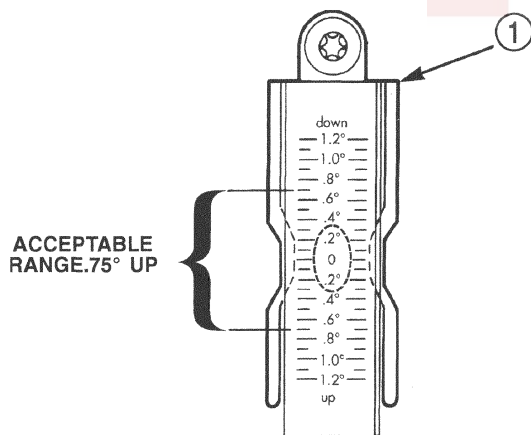
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## GENERAL INFORMATION

### HEADLAMP ALIGNMENT

#### DESCRIPTION

JX vehicle headlamps are equipped with a bubble level to aid up/down headlamp alignment (Fig. 1). The bubble level is used to assist headlamp alignment when compensating for vehicle ride height changes due to heavy luggage compartment loads. The bubble level cannot be calibrated, the headlamp must be replaced if bubble level vial is faulty. A gauge wheel is located on the top of the headlamp module to assist left/right alignment (Fig. 2).



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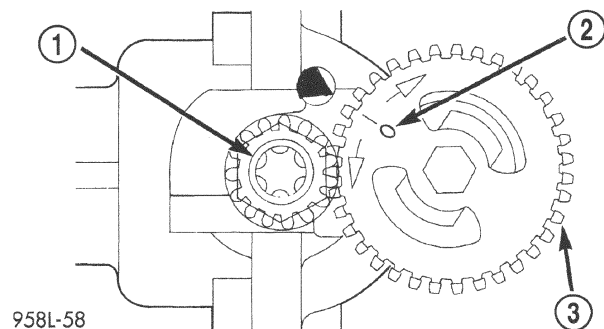
**Fig. 1 Bubble Level**

1 - BUBBLE LEVEL

## ADJUSTMENTS

### HEADLAMP ALIGNMENT PREPARATION

- (1) Verify headlamp dimmer switch and high beam indicator operation.
- (2) Inspect and correct damaged or defective components that could interfere with proper headlamp alignment.
- (3) Verify proper tire inflation.
- (4) Clean headlamp lenses.



**Fig. 2 Gauge Wheel - Typical**

- 1 - ADJUSTER
- 2 - ZERO MARK
- 3 - GAUGE WHEEL

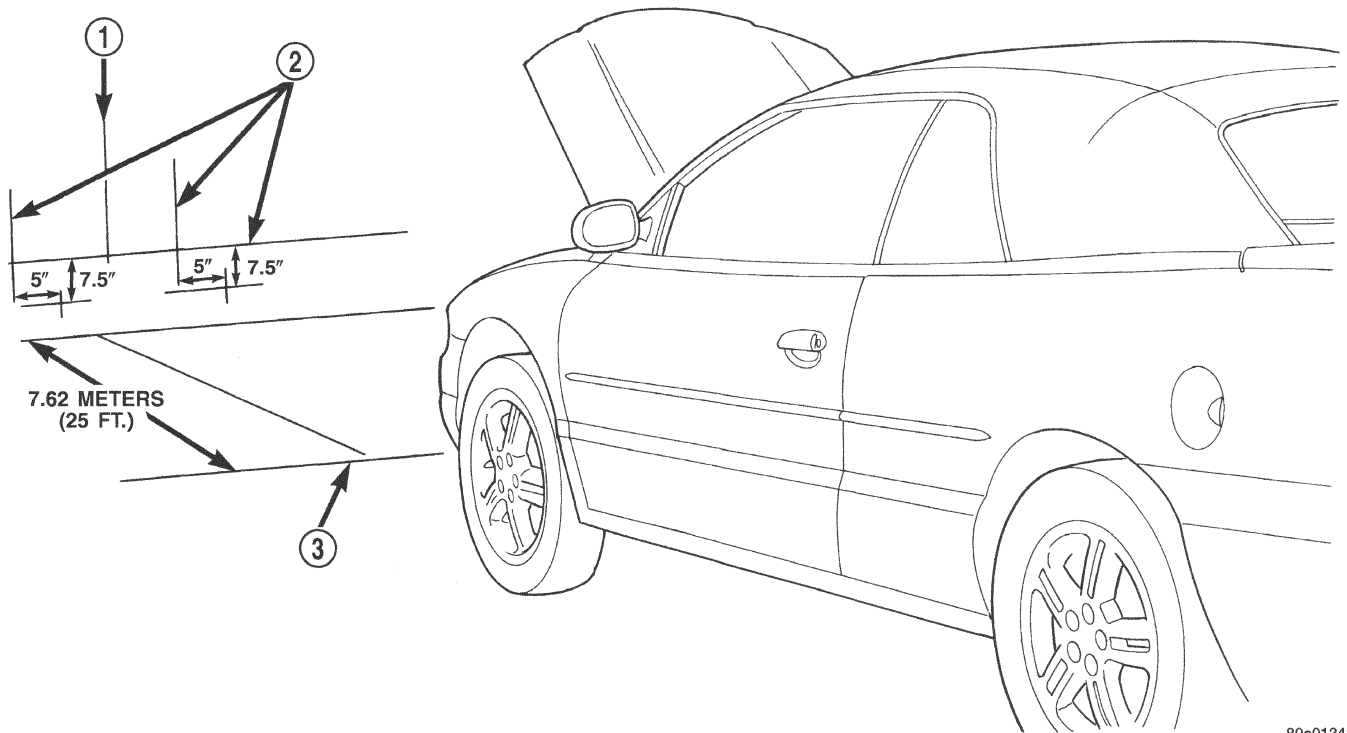
- (5) Verify that luggage area is not heavily loaded.
- (6) Fuel tank should be FULL. Add 2.94 kg (6.5 lbs.) of weight over the fuel tank for each estimated gallon of missing fuel.

### HEADLAMP ADJUSTMENT USING ALIGNMENT SCREEN

#### ALIGNMENT SCREEN PREPARATION

- (1) Position vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 ft.) away from front of headlamp lens (Fig. 3).
- (2) If necessary, tape a line on the floor 7.62 meters (25 ft.) away from and parallel to the wall.
- (3) From the ground up 1.27 meters (5 ft.), tape a line on the wall at the center line of the vehicle. Sight along the center line of the vehicle (from rear of vehicle forward) to verify accuracy of the line placement.
- (4) Rock vehicle side-to-side three times to allow suspension to stabilize.
- (5) Jounce front suspension three times by pushing downward on front bumper and releasing.
- (6) Measure the distance from the center of headlamp lens to the ground. Transfer measurement to the alignment screen (with tape). Use this line for up/down adjustment reference.

## ADJUSTMENTS (Continued)



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**Fig. 3 Headlamp Alignment Screen**

- 1 - CENTER OF VEHICLE  
2 - CENTER OF HEADLAMPS

- 3 - FRONT OF HEADLAMP

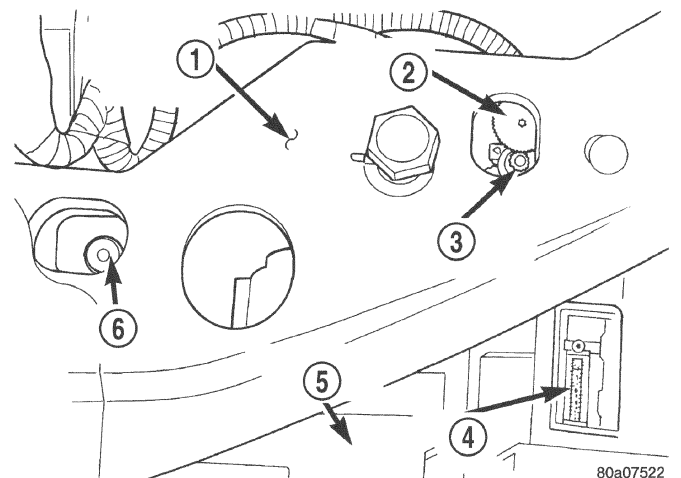
(7) Measure distance from the center line of the vehicle to the center of each headlamp being aligned. Transfer measurements to screen (with tape) to each side of vehicle center line. Use these lines for left/right adjustment reference.

### HEADLAMP ADJUSTMENT

A properly aimed low beam headlamp will project the center of the low beam hot spot on the alignment screen 190 mm (7.5 in.) below the headlamp center line. The side-to-side low beam hot spot should be 127 mm (5 in.) right of headlamp center line (Fig. 3). **The preferred headlamp alignment is 0 ( $\pm 0.76^\circ$ ) for the up/down adjustment as indicated on bubble level. Preferred left/right alignment is 0 ( $\pm 0.76^\circ$ ) as indicated on the gauge wheel.** The high beam headlamps cannot be aligned. The high beam pattern should be correct when the low beams are aligned properly.

**NOTE:** The bubble level and gauge wheel is calibrated before the headlamp is installed in the vehicle. The bubble level cannot be calibrated without damaging the headlamp module. If bubble level is faulty, replace headlamp module.

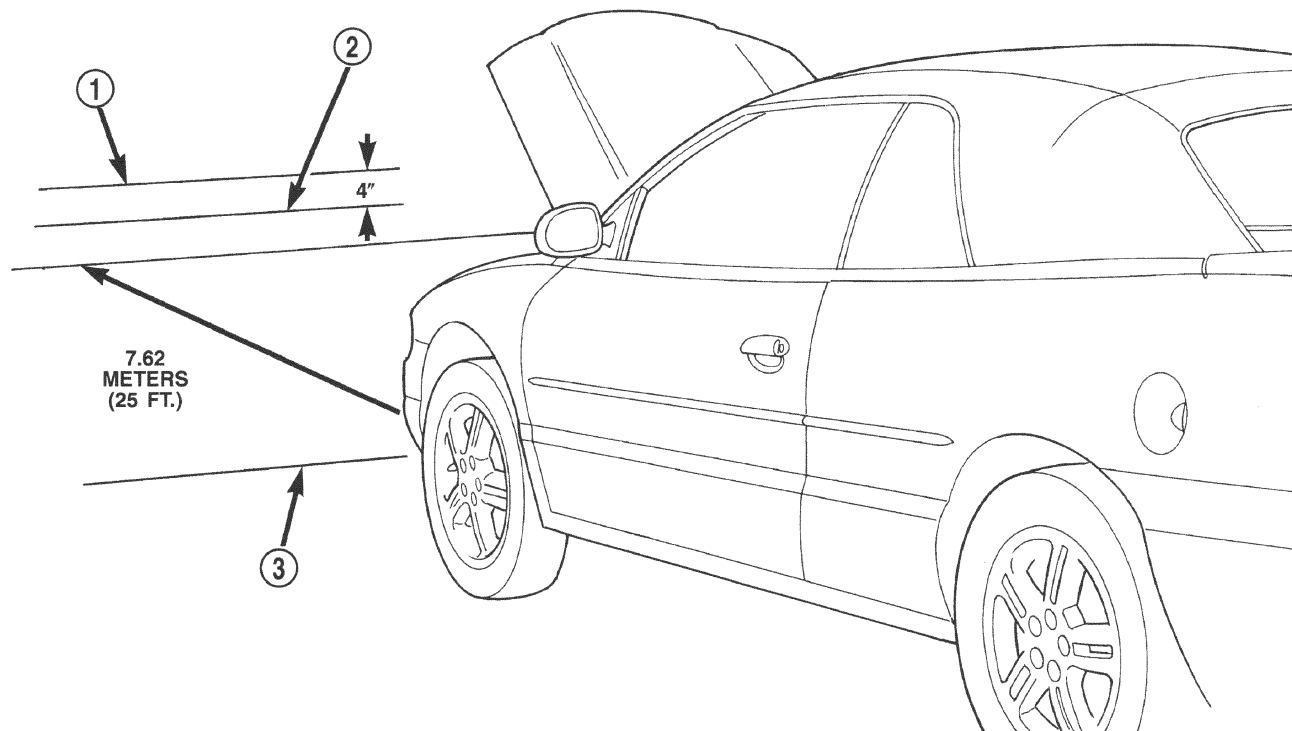
To adjust headlamp alignment, rotate alignment screws to achieve the specified low beam hot spot pattern (Fig. 4).



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**Fig. 4 Headlamp Alignment Screws**

- 1 - RADIATOR CLOSURE PANEL  
2 - GAUGE WHEEL  
3 - LEFT/RIGHT ADJUSTER  
4 - BUBBLE VIAL  
5 - HEADLAMP MODULE  
6 - UP/DOWN ADJUSTER

**ADJUSTMENTS (Continued)**

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**Fig. 5 Fog Lamp Alignment**

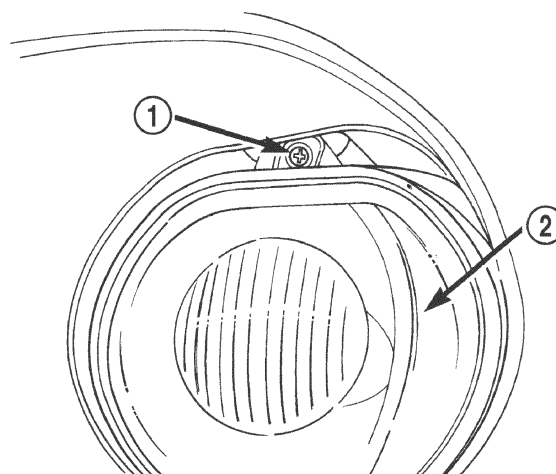
- 1 - CENTER OF FOGLAMP  
2 - TOP OF BEAM PATTERN

- 3 - FRONT OF FOGLAMP

**FOG LAMP ALIGNMENT**

Prepare a alignment screen (Fig. 5). Refer to Alignment Screen Preparation paragraph in this section. A properly aligned fog lamp will project a pattern on the alignment screen 100 mm (4 in.) below the fog lamp center line and straight ahead.

To adjust fog lamp alignment, rotate alignment screw to achieve the specified hot spot pattern (Fig. 6).



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**Fig. 6 Fog Lamp Adjuster**

- 1 - UP/DOWN ADJUSTER  
2 - FOGLAMP



## EXTERIOR LAMP SWITCHES

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### REMOVAL AND INSTALLATION

#### HEADLAMP SWITCH

Service procedures for the headlamp switch can be found in Group 8E, Instrument Panel and Gauges. More information can be found in Group 8W, Wiring Diagrams.

#### HEADLAMP DIMMER SWITCH

The headlamp dimmer switch is incorporated into the turn signal switch. Proper procedures can be found in Group 8J, Turn Signal and Flashers. More information can be found in Group 8W, Wiring Diagrams.



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## LAMP BULB SERVICE

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## REMOVAL AND INSTALLATION

### HEADLAMP BULB

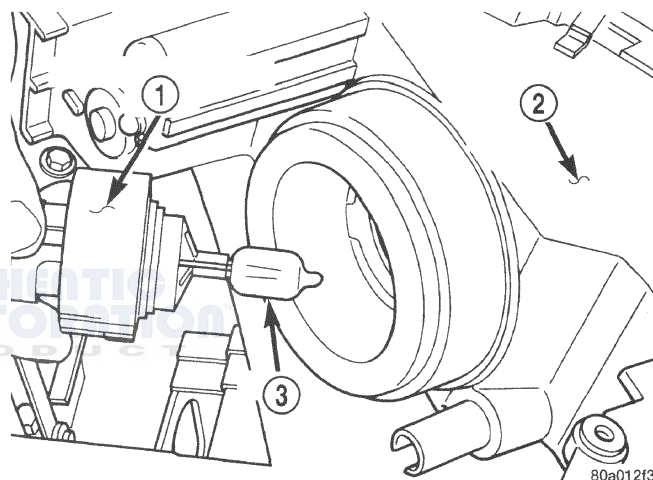
#### REMOVAL

**CAUTION:** Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

- (1) Release hood latch and open hood.
- (2) Remove screws attaching headlamp module to radiator closure panel.
- (3) Remove headlamp module from radiator closure panel.
- (4) Rotate retaining ring counterclockwise one quarter turn.
- (5) Disconnect wire connector from back of headlamp bulb.
- (6) Remove retaining ring from headlamp module.
- (7) Pull bulb from headlamp module (Fig. 1).

#### INSTALLATION

- (1) Insert bulb into headlamp module.
- (2) Position retaining ring to headlamp module.
- (3) Rotate retaining ring clockwise one quarter turn.
- (4) Connect wire connector from back of headlamp bulb.
- (5) Position headlamp module to radiator closure panel.
- (6) Install screws attaching headlamp module to radiator closure panel.
- (7) Verify proper headlamp alignment. Adjust as necessary.



**Fig. 1 Headlamp Bulb**

- 1 - BULB RETAINING RING
- 2 - HEADLAMP MODULE
- 3 - BULB

### FOG LAMP BULB

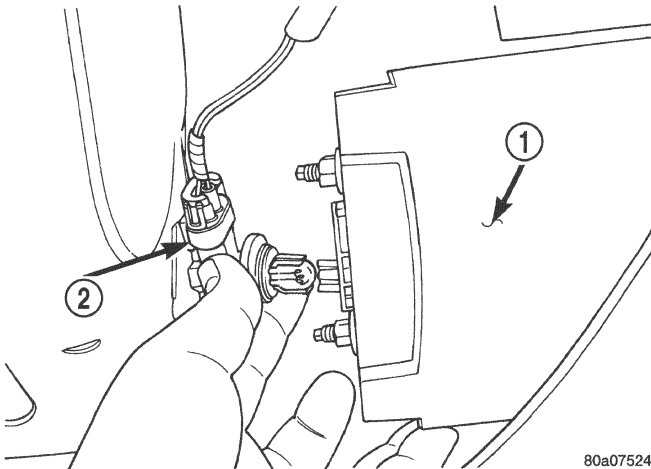
#### REMOVAL

- (1) Raise vehicle with suitable lifting device. Refer to Group 0, Lubrication and Maintenance, for proper procedures.
- (2) Rotate bulb one quarter turn counterclockwise.
- (3) Pull bulb from back of fog lamp (Fig. 2).
- (4) Disconnect wire connector from bulb.

#### INSTALLATION

- (1) Connect wire connector to fog lamp bulb.
- (2) Push bulb into back of fog lamp.
- (3) Rotate bulb one quarter turn clockwise.
- (4) Lower vehicle.

## REMOVAL AND INSTALLATION (Continued)



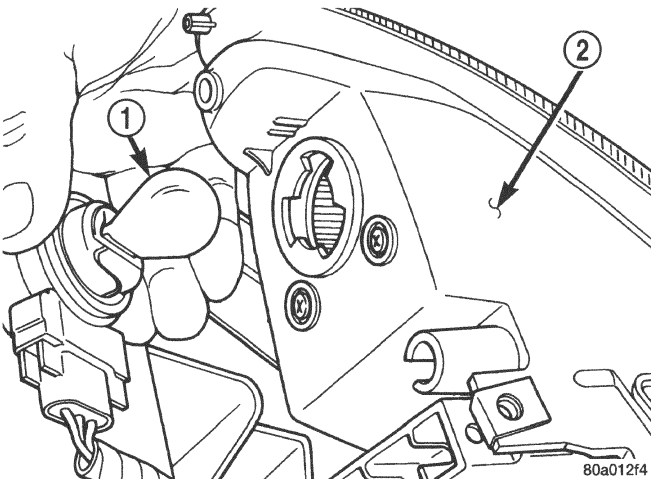
**Fig. 2 Fog Lamp Bulb**

- 1 - FASCIA FOGLAMP HOUSING  
2 - FOGLAMP BULB

## PARK AND TURN SIGNAL LAMP BULB

### REMOVAL

- (1) Release hood latch and open hood.
- (2) Remove screws attaching headlamp module to radiator closure panel.
- (3) Remove headlamp module from radiator closure panel.
- (4) Rotate socket counterclockwise one quarter turn.
- (5) Pull socket from back of lamp (Fig. 3).
- (6) Pull bulb from socket.



**Fig. 3 Park and Turn Signal Lamp Bulb**

- 1 - BULB  
2 - HEADLAMP MODULE

### INSTALLATION

- (1) Push bulb into socket.
- (2) Position socket into back of lamp.
- (3) Rotate socket clockwise one quarter turn.

(4) Position headlamp module to radiator closure panel.

(5) Install screws attaching headlamp module to radiator closure panel.

(6) Verify proper headlamp alignment.

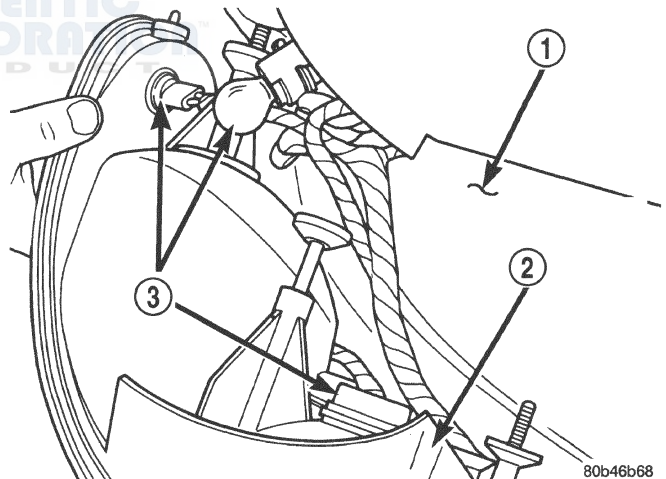
## CENTER HIGH MOUNTED STOP LAMP (CHMSL) BULB

The center high mounted stop lamp (CHMSL) has no serviceable bulb. If the lamp does not function properly, the CHMSL assembly must be replaced.

## TAIL, BRAKE AND TURN SIGNAL LAMP BULBS

### REMOVAL

- (1) Release decklid latch and open decklid.
- (2) Remove trunk lining as necessary to gain access to tail lamp nuts.
- (3) Remove plastic nuts attaching tail lamp to rear closure panel.
- (4) Remove lamp from opening in quarter panel.
- (5) Rotate socket counterclockwise one quarter turn.
- (6) Pull socket from back of lamp (Fig. 4).
- (7) Pull bulb from socket.



**Fig. 4 Tail, Brake, and Turn Signal Lamp Bulb**

- 1 - REAR CLOSURE PANEL  
2 - TAIL, STOP, TURN SIGNAL LAMP HOUSING  
3 - BULBS

### INSTALLATION

- (1) Push bulb into socket.
- (2) Push socket into back of lamp.
- (3) Rotate socket clockwise one quarter turn.
- (4) Position lamp to opening in quarter panel.
- (5) Install plastic nuts attaching tail lamp to rear closure panel.
- (6) Install trunk lining.
- (7) Close decklid.



**REMOVAL AND INSTALLATION (Continued)****BACK-UP LAMP BULB****REMOVAL**

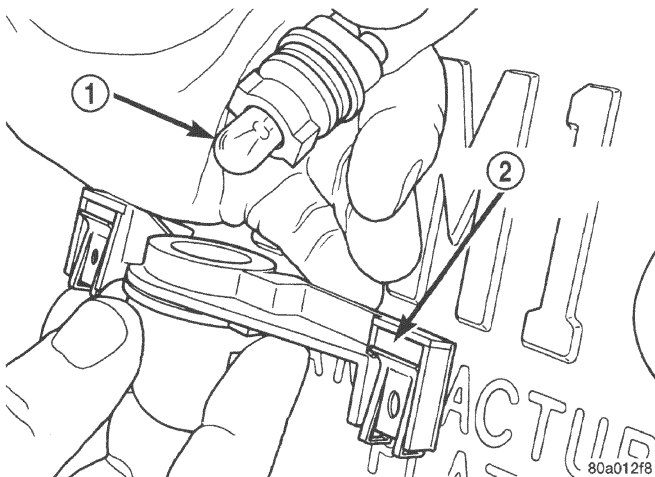
- (1) Release decklid latch and open decklid.
- (2) Remove trunk lining as necessary to gain access to tail lamp nuts.
- (3) Remove plastic nuts attaching tail lamp to rear closure panel.
- (4) Remove lamp from opening in quarter panel.
- (5) Rotate socket counterclockwise one quarter turn.
- (6) Pull socket from back of lamp.
- (7) Pull bulb from socket.

**INSTALLATION**

- (1) Push bulb into socket.
- (2) Push socket into back of lamp.
- (3) Rotate socket clockwise one quarter turn.
- (4) Position tail lamp to opening in quarter panel.
- (5) Install plastic nuts attaching tail lamp to rear closure panel.
- (6) Install trunk lining.

**LICENSE PLATE LAMP BULB****REMOVAL**

- (1) Remove screws attaching license plate lamp to rear bumper fascia.
- (2) Remove license plate lamp from rear fascia.
- (3) Rotate socket counterclockwise one quarter turn.
- (4) Pull socket from back of lamp (Fig. 5).
- (5) Pull bulb from socket.

**Fig. 5 License Plate Lamp Bulb**

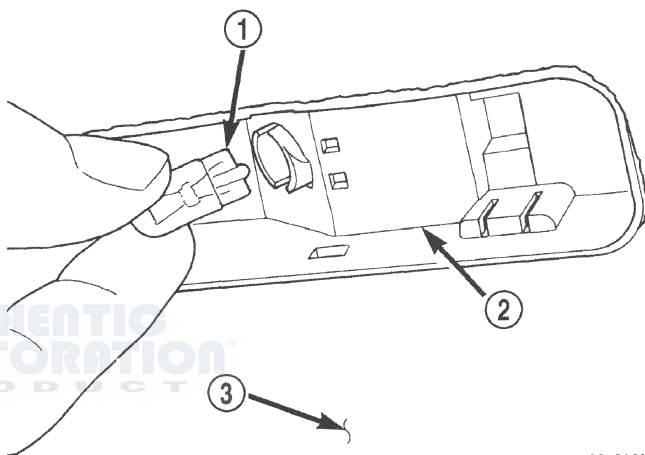
- 1 - BULB  
2 - LICENSE PLATE LAMP

**INSTALLATION**

- (1) Push bulb into socket.
- (2) Push socket into back of lamp.
- (3) Rotate socket clockwise one quarter turn.
- (4) Position license plate lamp to rear fascia.
- (5) Install screws attaching license plate lamp to rear bumper fascia.

**DOOR COURTESY LAMP BULB****REMOVAL**

- (1) Using a small, flat bladed tool inserted into rear edge of door courtesy lamp lens, remove lens.
- (2) Pull courtesy lamp bulb from bulb socket (Fig. 6).



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**Fig. 6 Door Courtesy Lamp Bulb**

- 1 - BULB  
2 - COURTESY LAMP HOUSING  
3 - DOOR TRIM PANEL

**INSTALLATION**

- (1) Push courtesy lamp bulb into bulb socket.
- (2) Insert front edge of courtesy lamp lens to lamp housing.
- (3) Snap lamp lens into lamp housing.

**FRONT MAP LAMP BULB****REMOVAL**

- (1) Using a small, flat bladed tool inserted into slot in lamp lens, remove map lamp lens.
- (2) Pull bulb from map lamp.

**INSTALLATION**

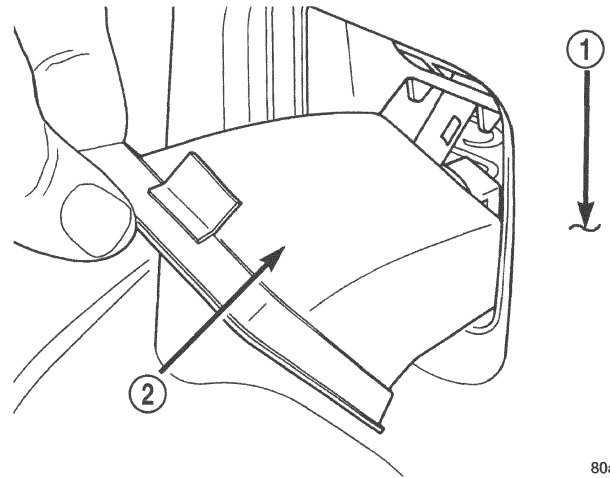
- (1) Push bulb into map lamp.
- (2) Install map lamp lens.

**REMOVAL AND INSTALLATION (Continued)****ASH RECEIVER/CUP HOLDER LAMP BULB****REMOVAL**

- (1) Use a small, flat bladed pry tool, insert into the slot in lamp bezel, and push inward to release from cubby bin.
- (2) Pull lamp assembly from cubby bin.
- (3) Remove lamp cover.
- (4) Remove bulb.

**INSTALLATION**

- (1) Install bulb.
- (2) Install lamp cover.
- (3) Position lamp assembly into cubby bin connector end first, and snap lamp into cubby bin.



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**Fig. 7 Floor Console Courtesy Lamp**

- 1 - FLOOR CONSOLE  
2 - FLOOR CONSOLE COURTESY LAMP

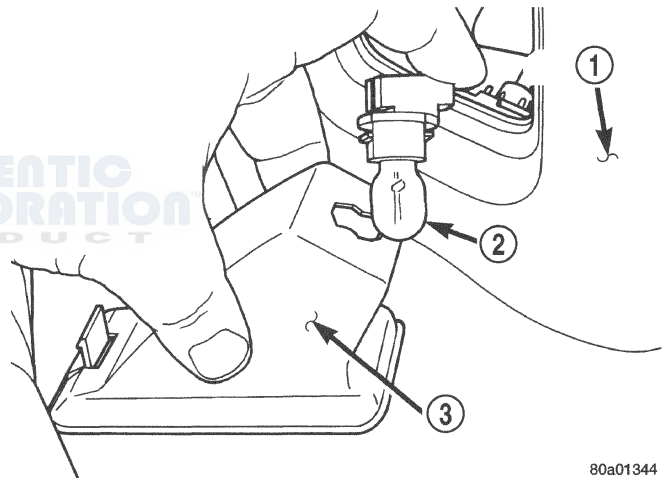
**FLOOR CONSOLE COURTESY LAMP BULB****REMOVAL**

- (1) Using a small, flat bladed tool inserted into top edge of courtesy lamp, remove courtesy lamp from floor console (Fig. 7).
- (2) Rotate bulb socket counterclockwise one quarter turn.
- (3) Pull bulb socket from courtesy lamp.
- (4) Pull bulb from bulb socket (Fig. 8).

**INSTALLATION**

- (1) Push bulb into bulb socket.
- (2) Push bulb socket into courtesy lamp.
- (3) Rotate bulb socket clockwise one quarter turn.
- (4) Position lower edge of courtesy lamp to floor console.
- (5) Snap courtesy lamp into floor console.

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**Fig. 8 Floor Console Courtesy Lamp Bulb**

- 1 - FLOOR CONSOLE  
2 - BULB  
3 - FLOOR CONSOLE COURTESY LAMP

**LIGHTED TRANSMISSION RANGE INDICATOR LETTER BEZEL LAMP**

The Lighted Transmission Range Indicator Letter Bezel Lamp, is not a serviceable lamp. If the lamp does not function properly, the Lighted Transmission Range Indicator Letter Bezel assembly must be replaced.

## LAMP HOUSING

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## REMOVAL AND INSTALLATION

### HEADLAMP MODULE

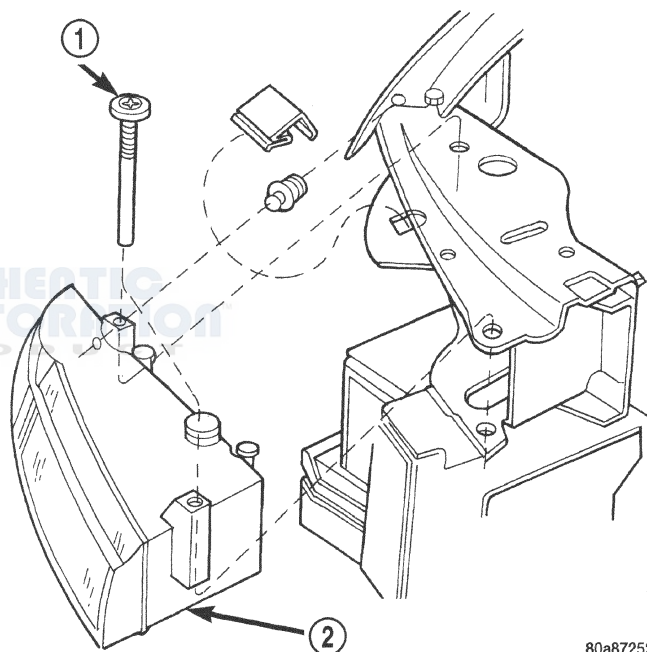
The headlamp module contains the park and turn signal lamps and is serviced as an assembly.

#### REMOVAL

- (1) Release hood latch and open hood.
- (2) Remove screws attaching headlamp module to radiator closure panel and headlamp adapter (Fig. 1).
- (3) Remove headlamp module from radiator closure panel (Fig. 2).
- (4) Disconnect wire connector from headlamp bulb socket.
- (5) Rotate park/turn signal lamp socket one quarter turn counterclockwise.
- (6) Pull park/turn signal socket from headlamp module.
- (7) Remove headlamp module from vehicle.

#### INSTALLATION

- (1) Position headlamp module to vehicle.
- (2) Push park/turn signal socket into headlamp module.
- (3) Rotate park/turn signal lamp socket one quarter turn clockwise.
- (4) Connect wire connector to headlamp bulb socket.
- (5) Position headlamp module to radiator closure panel.
- (6) Install screws attaching headlamp module to radiator closure panel.
- (7) Verify proper headlamp alignment.



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**Fig. 1 Headlamp Module Screws**

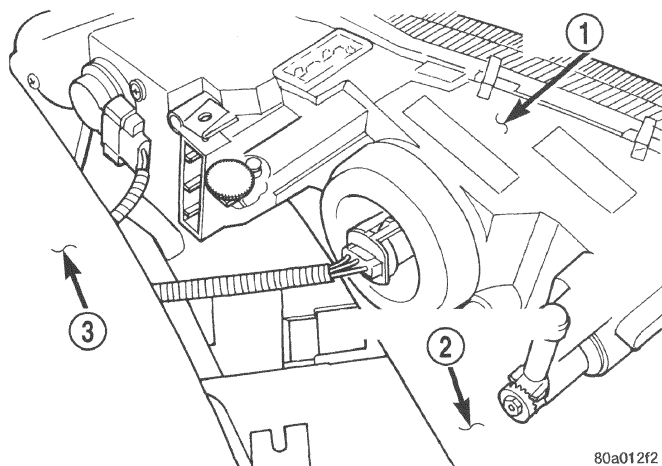
- 1 - MODULE SCREWS  
2 - HEADLAMP MODULE

### FOG LAMP

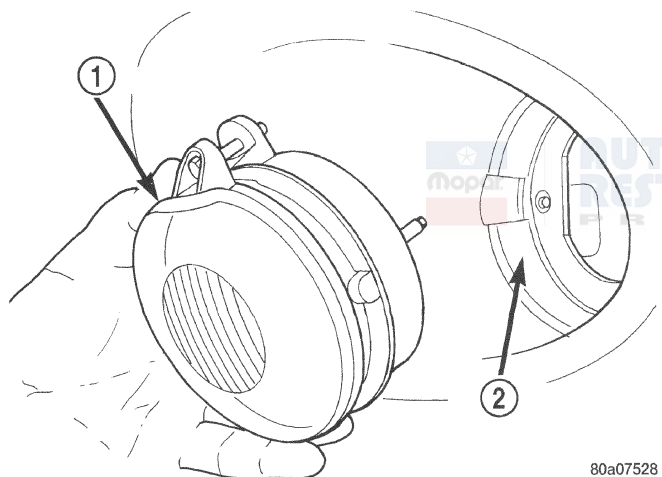
#### REMOVAL

- (1) Raise vehicle with suitable lifting device. Refer to Group 0, Lubrication and Maintenance, for proper procedures.
- (2) Disconnect wire connector from fog lamp bulb.
- (3) Remove nuts attaching fog lamp to front fascia.
- (4) Remove fog lamp from front fascia.



**REMOVAL AND INSTALLATION (Continued)****Fig. 2 Headlamp Module**

- 1 - HEADLAMP MODULE
- 2 - FRONT BUMPER FASCIA
- 3 - RADIATOR CLOSURE PANEL

**Fig. 3 Fog Lamp**

- 1 - FOGLAMP
- 2 - FASCIA FOGLAMP HOUSING

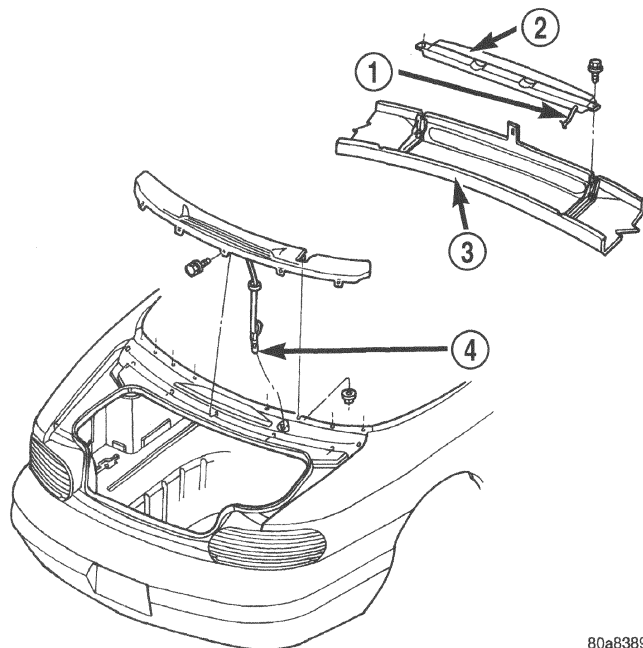
**INSTALLATION**

- (1) Position fog lamp in front fascia.
- (2) Install nuts attaching fog lamp to front fascia.
- (3) Connect wire connector to fog lamp bulb.

**CENTER HIGH MOUNTED STOP LAMP (CHMSL)****REMOVAL**

- (1) Remove upper deck molding. Refer to Group 23, Body, for proper procedure.
- (2) Remove screws attaching CHMSL assembly to upper deck molding (Fig. 4).
- (3) Remove trunk trim panel as necessary to connect CHMSL wire connector.

- (4) Remove CHMSL from upper deck molding.

**Fig. 4 Center High Mount Stop Lamp**

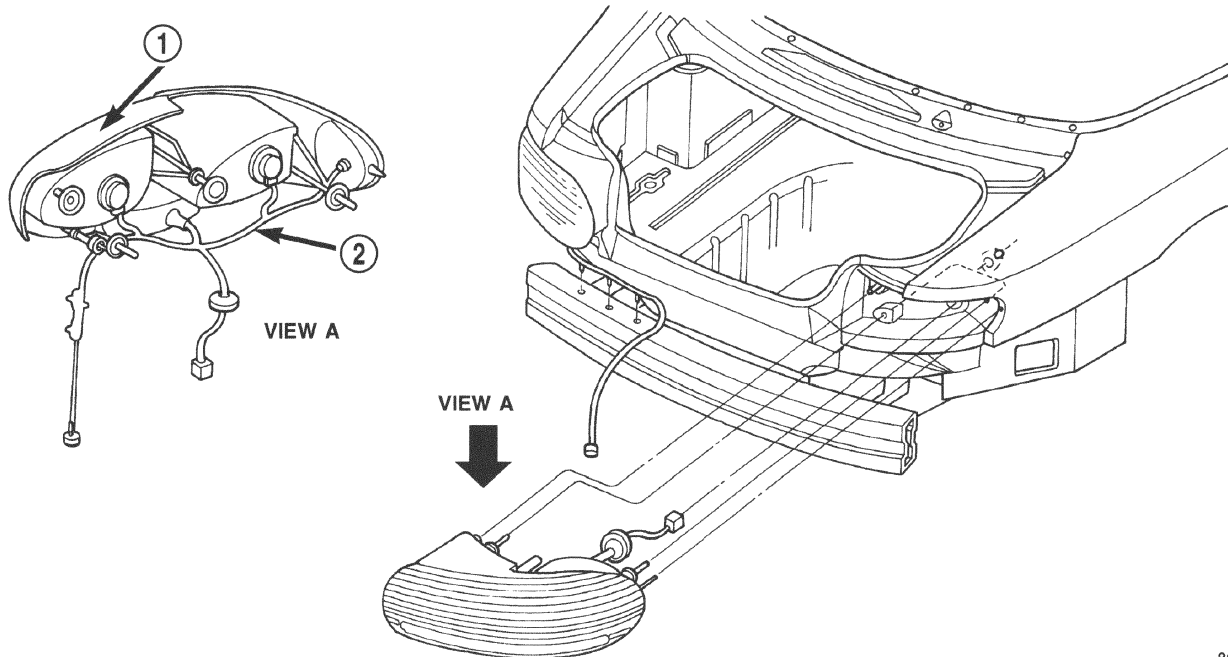
- 1 - WIRE HARNESS
- 2 - CHMSL
- 3 - UPPER DECK MOLDING
- 4 - WIRE CONNECTOR

**INSTALLATION**

- (1) Position CHMSL to upper deck molding.
- (2) Connect CHMSL wire connector and reposition trunk trim panel.
- (3) Install screws attaching CHMSL assembly to upper deck molding.
- (4) Install upper deck molding. Refer to Group 23, Body, for proper procedure.

**TAIL, BRAKE, TURN SIGNAL, BACKUP AND SIDE MARKER LAMPS****REMOVAL**

- (1) Release decklid latch and open decklid.
- (2) Remove trunk lining as necessary to gain access to tail lamp nuts.
- (3) Remove plastic nuts attaching tail lamp to rear closure panel.
- (4) Remove lamp from opening in quarter panel (Fig. 5).
- (5) Rotate bulb sockets counterclockwise one quarter turn.
- (6) Pull bulb sockets from back of lamp.
- (7) Remove tail, brake, turn signal, backup and side marker lamps from vehicle.

**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 5 Tail, Brake, Turn Signal, Backup and Side Marker Lamp**

1 - TAIL, STOP, TURN SIGNAL, BACKUP AND SIDEMARKER LAMP

2 - WIRE HARNESS

**INSTALLATION**

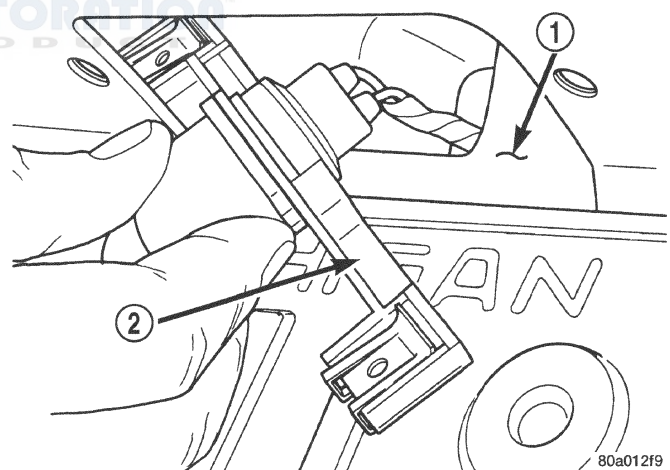
- (1) Position tail, brake, turn signal, backup and side marker lamp to vehicle.
- (2) Push bulb sockets into back of lamp.
- (3) Rotate bulb sockets clockwise one quarter turn.
- (4) Position lamp to opening in quarter panel.
- (5) Install plastic nuts to attach tail lamp to rear closure panel in the following sequence: outboard, center, inboard.
- (6) Install trunk lining.

**LICENSE PLATE LAMP****REMOVAL**

- (1) Remove screws attaching license plate lamp to rear bumper fascia.
- (2) Remove license plate lamp from rear fascia (Fig. 6).
- (3) Rotate socket counterclockwise one quarter turn.
- (4) Pull socket from back of lamp.
- (5) Remove license plate lamp from vehicle.

**INSTALLATION**

- (1) Position license plate lamp to vehicle.
- (2) Push socket into back of lamp.
- (3) Rotate socket clockwise one quarter turn.
- (4) Position license plate lamp to rear fascia.
- (5) Install screws attaching license plate lamp to rear bumper fascia.



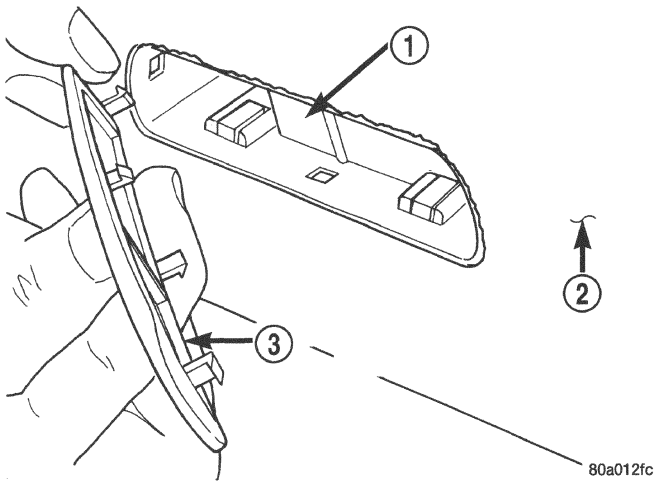
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**Fig. 6 License Plate Lamp**1 - REAR BUMPER FASCIA  
2 - LICENSE PLATE LAMP**DOOR COURTESY LAMP****REMOVAL**

- (1) Using a small, flat bladed tool inserted into rear edge of door courtesy lamp lens, remove lens (Fig. 7).
- (2) Pull courtesy lamp from door trim panel (Fig. 8).
- (3) Disengage wire connector from courtesy lamp bulb socket.

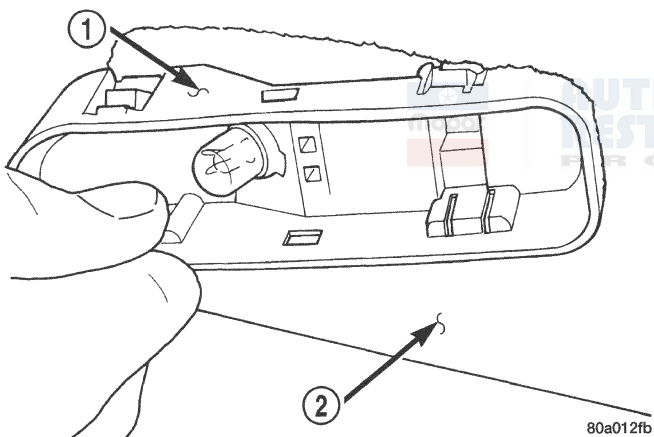
**REMOVAL AND INSTALLATION (Continued)**

- (4) Remove courtesy lamp from vehicle.



**Fig. 7 Courtesy Lamp Lens**

- 1 - COURTESY LAMP HOUSING  
2 - DOOR TRIM PANEL  
3 - COURTESY LAMP LENS



**Fig. 8 Courtesy Lamp**

- 1 - COURTESY LAMP HOUSING  
2 - DOOR TRIM PANEL

**INSTALLATION**

- (1) Position courtesy lamp from vehicle.
- (2) Connect wire connector to courtesy lamp bulb socket.
- (3) Push courtesy lamp into door trim panel (Fig. 8).
- (4) Insert front edge of courtesy lamp lens to lamp housing.
- (5) Snap lamp lens into lamp housing.

**FRONT MAP LAMP**

The front map lamp is not a serviceable component. If the front map lamp does not operate properly, the rear view mirror assembly must be replaced.

**ASH RECEIVER/CUP HOLDER LAMP****REMOVAL**

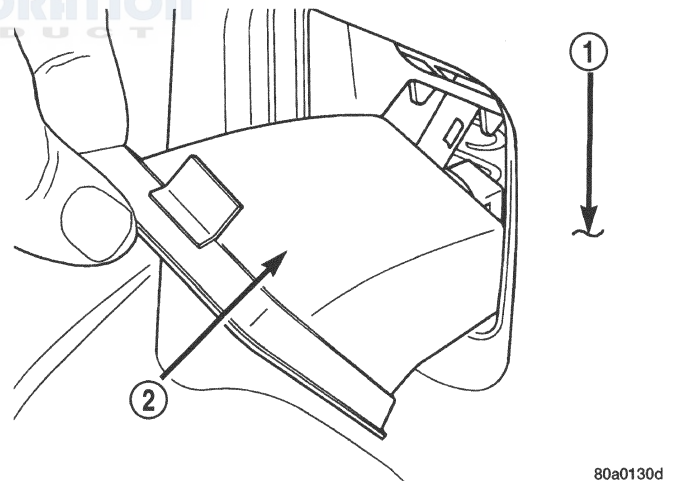
- (1) Using a small, flat bladed pry tool inserted into slot in lamp bezel, release tab holding lamp to cubby bin.
- (2) Pull bezel and lamp assembly from cubby bin.
- (3) Disconnect wire connector from lamp assembly.
- (4) Remove lamp assembly from vehicle.

**INSTALLATION**

- (1) Position lamp assembly to vehicle.
- (2) Connect wire connector to lamp assembly.
- (3) Push bezel and lamp assembly into cubby bin to engage tabs.

**FLOOR CONSOLE COURTESY LAMP****REMOVAL**

- (1) Using a small, flat bladed tool inserted into slot in top edge of courtesy lamp, remove courtesy lamp from floor console (Fig. 9).
- (2) Rotate bulb socket counterclockwise one quarter turn.
- (3) Pull bulb socket from courtesy lamp (Fig. 10).
- (4) Remove console courtesy lamp from vehicle.



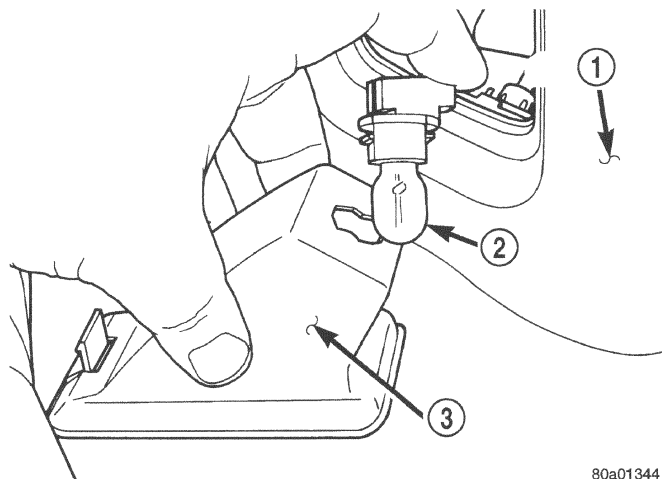
**Fig. 9 Floor Console Courtesy Lamp**

- 1 - FLOOR CONSOLE  
2 - FLOOR CONSOLE COURTESY LAMP

**INSTALLATION**

- (1) Place console courtesy lamp in position.
- (2) Push bulb socket into courtesy lamp.
- (3) Rotate bulb socket clockwise one quarter turn.
- (4) Position lower edge of courtesy lamp to floor console.
- (5) Snap courtesy lamp into floor console.



**REMOVAL AND INSTALLATION (Continued)****Fig. 10 Floor Console Courtesy Lamp Bulb**

- 1 - FLOOR CONSOLE
- 2 - BULB
- 3 - FLOOR CONSOLE COURTESY LAMP

**LIGHTED TRANSMISSION RANGE INDICATOR LETTER BEZEL****REMOVAL**

- (1) Remove floor console. Refer to Group 23, Body, for proper procedure.
- (2) Disconnect the wire harness connector on bottom-side of floor console.
- (3) Disconnect the inverter for lighted Transmission Range Indicator letter bezel from shifter cover.

(4) Pull bezel downward through access hole in floor console.

(5) Remove lighted transmission range indicator letter bezel from vehicle.

**INSTALLATION**

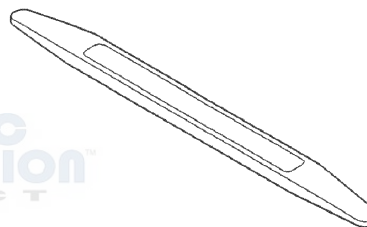
(1) Position lighted transmission range indicator letter bezel to vehicle.

(2) Push bezel upward through access hole in floor console.

(3) Connect inverter for lighted transmission range indicator letter bezel to shifter cover.

(4) Connect the wire harness connector on bottom-side of floor console.

(5) Install floor console. Refer to Group 23, Body, for proper procedure.

**SPECIAL TOOLS****LAMP SERVICE****Trim Stick C-4755**

# LAMP SYSTEMS

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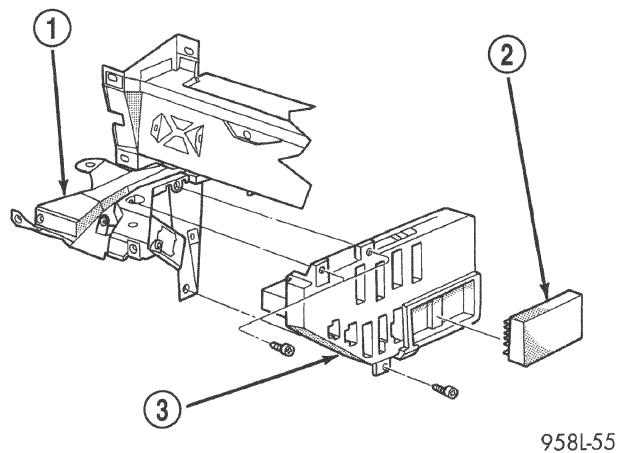
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## DESCRIPTION AND OPERATION

### DAYTIME RUNNING LAMP (CANADA)

#### DESCRIPTION

JX vehicles built for use in Canada are equipped with a Daytime Running Lamp (DRL) system. The DRL system operates the headlamps at 50% illumination with the headlamp switch OFF, park brake released and the ignition ON. The DRL system is controlled by the Daytime Running Lamp Module located on the back of the multi-function module behind the instrument panel (Fig. 1). The DRL module overrides the headlamp switch when the headlamps are turned OFF. The headlamps operate normally when the headlamps are turned ON. Refer to Group 8W, Wiring Diagrams, for component locations and circuit information.



958L-55

**Fig. 1 Daytime Running Lamp Module**

- 1 - FUSE BLOCK BRACKET
- 2 - DAYTIME RUNNING LAMP MODULE
- 3 - MULTI FUNCTION MODULE

### HEADLAMP TIME DELAY SYSTEM

#### DESCRIPTION

The optional Headlamp Time Delay system is controlled by the Body Controller (BC) and a relay located in the junction block. The headlamp time delay system can be activated by turning ON the headlamps when the engine is running, turn OFF the ignition switch, then turn OFF the headlamp switch. The BC will allow the headlamps to remain ON for 90 seconds before they automatically turn off. Refer to the Owner's Manual for more information.

### ILLUMINATED ENTRY

#### DESCRIPTION

The Illuminated Entry System is available on vehicles equipped with the Remote Keyless Entry system. The Illuminated Entry System turns ON the courtesy lamps when the remote keyless entry system is activated. The Remote Keyless Entry Module and the Body Controller are used to control the system. Courtesy lamps will turn on for 30 seconds ( $\pm 1$  second) and fade to OFF over a five second period.

The Illuminated Entry System also turns ON the courtesy lamps (and ignition switch lamp) when door is opened. The courtesy lamps will remain ON while the door is open, then fade to OFF 30 seconds ( $\pm 1$  second) after the last door is closed.

The courtesy and ignition switch lamps will fade to OFF immediately when the ignition is switched to ON.

The Illuminated Entry System cannot be activated during the 30 second ( $\pm 1$  second) period after the ignition switch is turned OFF. After a door is opened and closed during this 30 second period, the system will function as previously described.

When the battery voltage has been interrupted to the Illuminated Entry System, the system will not function until the remote keyless entry UNLOCK is actuated.

## DIAGNOSIS AND TESTING

### LAMP SYSTEM DIAGNOSTIC PROCEDURES

Refer to Group 8W, Wiring Diagrams for component location and circuit information. Refer to the Body Systems Diagnostic Procedures Manual for more information.

### ILLUMINATED ENTRY DIAGNOSTIC PROCEDURES

When testing the system, all doors must be closed to prevent courtesy lamps from lighting. Verify that

remote keyless entry system is operating properly before testing illuminated entry circuits. The body controller uses input from the remote keyless entry system to switch ON the courtesy lamps.

Refer to Group 8W, Wiring Diagrams for component location and circuit information. Refer to Body Systems Diagnostic Procedures Manual for more information.



**AUTHENTIC  
RESTORATION™**  
PRODUCT



## BULB APPLICATION

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### SPECIFICATIONS

#### EXTERIOR LAMPS

**CAUTION:** Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp can result.

**CAUTION:** Do not touch halogen bulbs with fingers or other oily surfaces. Bulb life will be reduced.

Headlamp . . . . .	9007QL or 9007
Fog lamp . . . . .	9006
Park/Turn Signal . . . . .	3157K or 3157
Center High Mounted Stop . . . . .	921 (W16W)
Tail/Brake/Turn Signal . . . . .	3457K (3357LL)
Back up . . . . .	921 (W16W)
Side Marker . . . . .	168
License Plate . . . . .	168

#### INTERIOR LAMPS

**CAUTION:** Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp can result.

**CAUTION:** Do not touch halogen bulbs with fingers or other oily surfaces. Bulb life will be reduced.

#### DIMMER CONTROLLED LAMPS

Service procedures for most of the lamps in the instrument panel, instrument cluster and switches are located in Group 8E, Instrument Panel and Gauges. Some components have lamps that can only be serviced by a Authorized Service Center (ASC) after the component is removed from the vehicle. Contact local dealer for location of nearest ASC.

A/C Heater Control . . . . .	37
A/C Heater ISO Symbols . . . . .	LED
Ash Receiver . . . . .	37
Instrument Cluster . . . . .	PC194
Radio . . . . .	ASC

#### INDICATOR LAMPS

Service procedures for most of the lamps in the instrument panel, instrument cluster and switches are located in Group 8E, Instrument Panel and Gauges.

A/C Compressor . . . . .	LED
Air Bag . . . . .	PC194
Anti-lock Brake . . . . .	PC194
Brake Warning . . . . .	PC194
Check Engine . . . . .	PC194
Console Shift Indicator . . . . .	LED
Engine Oil Pressure . . . . .	PC194
Engine Temperature . . . . .	PC194
Fog Lamp . . . . .	PC161
Generator . . . . .	PC194
High Beam . . . . .	PC194
Low Fuel . . . . .	PC194
Rear Window Defogger . . . . .	LED
Seat Belt . . . . .	PC194
Security Alarm . . . . .	LED
Shift Indicator . . . . .	VF Display
Speed Control . . . . .	PC194
Turn Signal . . . . .	PC194

#### NON-DIMMING LAMPS

Service procedures for most of the lamps in the following list can be found in Group 8L, Lamps. Some components have lamps that can only be serviced by a Authorized Service Center (ASC) after the component is removed from the vehicle. Contact local dealer for location of nearest ASC.

Door Courtesy Lamp . . . . .	168
Floor Console Courtesy Lamp . . . . .	906
Glove Box Lamp . . . . .	194
Ignition Lock . . . . .	4856321
Map Lamp . . . . .	212-2
Trunk . . . . .	912
Visor Vanity . . . . .	6501966

# PASSIVE RESTRAINT SYSTEMS

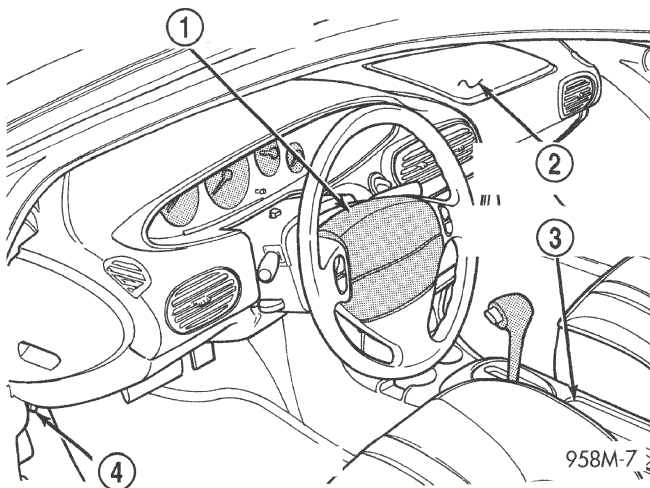
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## DESCRIPTION AND OPERATION

### AIRBAG CONTROL MODULE (ACM)

#### DESCRIPTION



**Fig. 1 Airbag Control Module (ACM) Location**

- 1 - DRIVER AIRBAG MODULE
- 2 - PASSENGER AIRBAG MODULE
- 3 - AIRBAG CONTROL MODULE
- 4 - DATA LINK CONNECTOR

The Airbag Control Module (ACM) contains the impact sensor and energy reserve capacitor. The impact sensor acts as a threshold sensitive switch that completes a circuit when an impact provides sufficient deceleration. The sensor is calibrated for the specific vehicle and reacts to the severity and direction of the impact.

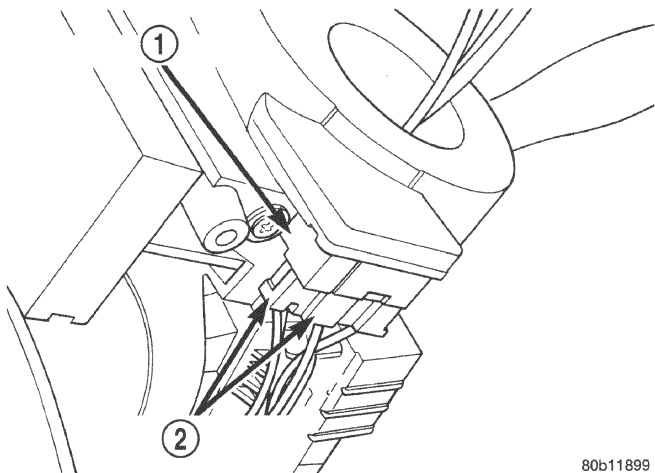
#### OPERATION

The ACM monitors the system to determine the system readiness. The ACM stores sufficient energy to deploy the airbags for approximately two minutes after the battery is disconnected. The ACM contains on-board diagnostics, and illuminates the AIRBAG warning lamp in the cluster when a diagnostic trouble code occurs. The warning equipment is tested for a few seconds every time the vehicle is started.

### CLOCKSPRING

#### DESCRIPTION

The clockspring is mounted to the steering column behind the steering wheel. The clockspring consists of a flat, ribbon like, electrically conductive tape that winds and unwinds with the steering wheel rotation.

**DESCRIPTION AND OPERATION (Continued)**

80b11899

**Fig. 2 Clockspring Location**

- 1 - CLOCKSPrING  
2 - WIRING HARNESS CONNECTORS

**OPERATION**

The clockspring is used to maintain a continuous electrical circuit between the wiring harness and the:

- Driver's airbag module
- Speed control switches
- Horn switch

**DRIVER AIRBAG MODULE**

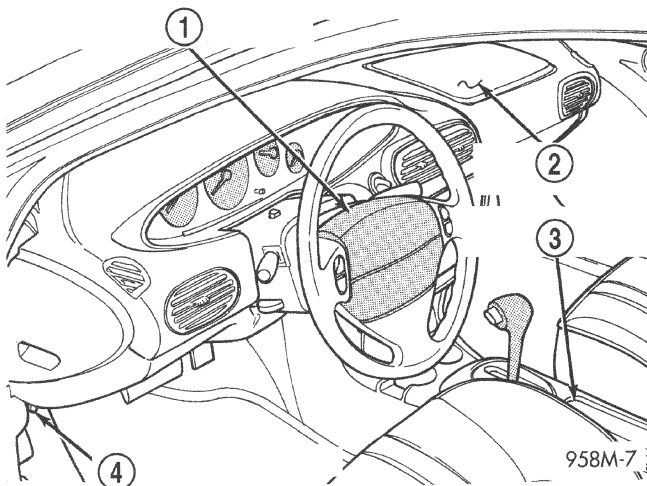
**WARNING: NEVER DISASSEMBLE THE DRIVER OR PASSENGER AIRBAG MODULES, THERE ARE NO SERVICEABLE PARTS WITHIN THE MODULES.**

**DESCRIPTION**

The Driver Airbag Module located in the center of the steering wheel is the most visible part of the system. It contains the airbag cushion and its supporting components. The airbag module contains a housing in which the cushion and inflator are attached and sealed.

**OPERATION**

The driver side inflator assembly is mounted from the back of the module housing. When supplied with the proper electrical signal, the inflator assembly produces a gas and discharges it directly into the cushion. A protective cover is fitted to the front of the Driver Airbag Module and forms a decorative cover in the center of the steering wheel. The Driver Airbag Module is mounted directly to the steering wheel.



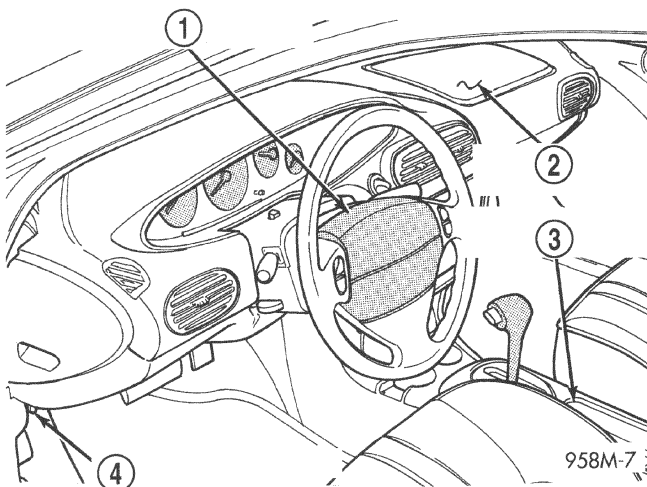
958M-7

**Fig. 3 Driver Airbag Module**

- 1 - DRIVER AIRBAG MODULE  
2 - PASSENGER AIRBAG MODULE  
3 - AIRBAG CONTROL MODULE  
4 - DATA LINK CONNECTOR

**PASSENGER AIRBAG MODULE**

**WARNING: NEVER DISASSEMBLE THE DRIVER OR PASSENGER AIRBAG MODULES, THERE ARE NO SERVICEABLE PARTS WITHIN THE MODULES.**

**DESCRIPTION**

958M-7

**Fig. 4 Passenger Airbag Module**

- 1 - DRIVER AIRBAG MODULE  
2 - PASSENGER AIRBAG MODULE  
3 - AIRBAG CONTROL MODULE  
4 - DATA LINK CONNECTOR

The Passenger Airbag Module is located beneath the decorative cover of the instrument panel, facing the passenger seat.



## DESCRIPTION AND OPERATION (Continued)

The PAB module is mounted to the instrument panel and pad assembly. The passenger inflator assembly is within the module housing. The module is mounted to the instrument panel retainer and support structure. A protective cover is fitted into the instrument panel over the airbag module and forms a decorative cover.

The Passenger Airbag Module (PAB) consists of:

- Inflator assembly
- Reaction canister
- Airbag Pillow
- Deployment door

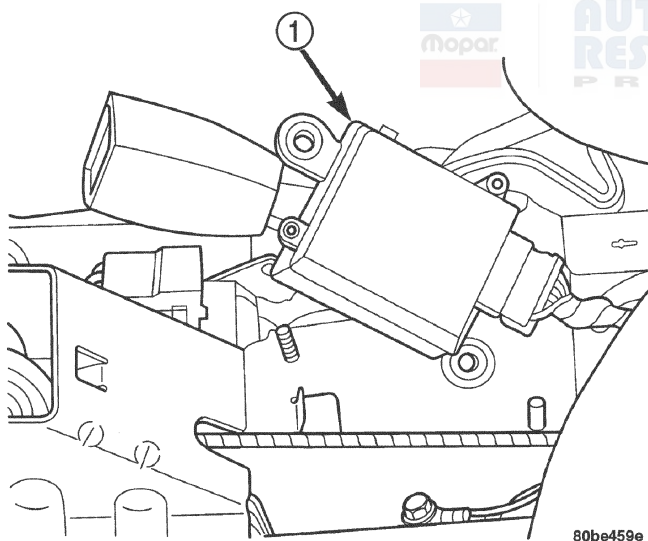
## OPERATION

When supplied with the proper electrical signal the inflator will produce a gas and discharge it directly into the cushion.

When supplied with the proper electrical signal, the inflator produces gas and discharges it directly into the pillow. The deployment door will hinge, allowing the pillow to fully inflate.

## SEATBELT CONTROL TIMER MODULE (SCTM)

### DESCRIPTION



**Fig. 5 Seatbelt Control Timer Module (SCTM)  
Location**

1 - SEATBELT CONTROL TIMER MODULE

This vehicle uses a convertible structural seatbelt system. Anchors hold the belt to the seat rather than the body. Embodied in the belt system is a Retractor-Integrated Height Adjuster. The purpose of the height Adjuster is to accommodate a wide range of occupant sizes.

The SCTM is mounted near the center of the vehicle. A G-sensor is located inside the module.

## OPERATION

This belt system attaches to a reclinable seat back so the traditional locking pendulum mechanism would not provide security. A solenoid was designed to lock the belt and was made part of each of the retractor mechanisms to each seat back. An impact sensor deactivates the solenoids. The impact sensor is a component of the Seatbelt Control Timer Module (SCTM) located under the center console.

The G-sensor is sensitive to frontal impact and to a roll or pitch or more than 45 degrees and to acceleration or deceleration equal to or greater than 0.7G in any direction.

## STRUCTURAL SEAT BELT SYSTEM

### DESCRIPTION

The structural seat with integrated Retractor Integrated Height Adjuster allows the seat belts to comfortably fit a large range of occupants. The seat belts are attached to the seat instead of the body, this allows better passenger access to the rear seat.

### OPERATION

Since the retractor is mounted on a seat back that can recline, a typical seat belt g-sensor cannot be used in the retractor. Instead, a solenoid inside the retractor is used to lock and unlock the seat belt when electrically signaled by a remote g-sensor. The remote g-sensor is located inside the Seat belt Control Timer Module (SCTM). The SCTM is located under the center console. The seat belt retractor solenoid is located in the seat back and is serviced as a assembly. The removal procedures are located in Group 23, Body.

When the solenoids are powered, the seat belt can be moved. When the solenoids are not powered, the seat belts can not be extracted. This is necessary to ensure that occupants are always safe, even in the case of a power loss during an accident. Whether the seat belts are in lock or unlock position, an occupant can always release the seat belt and it will retract.

The Seat Belt Control Timer Module controls the power to the seat belt solenoids. It supplies power continuously to the seat belts whenever the ignition key is in the RUN or ACCESSORY position. The module has two other unique functions: that of a timer and a g-sensor.

The Seat Belt Control Timer Module was designed with a timer function so that when the vehicle is not in use, the battery would not be prematurely drained. The module times out after approximately 30 minutes if no inputs are send to the module. The module will power the seat belts for a set period of time when there is a input:

- Either door ajar switch (open or closed)

**DESCRIPTION AND OPERATION (Continued)**

- Ignition switch moved from RUN or ACCESSORY to the OFF position.

Each time one of these input occurs, the timer is reset to keep the belts powered for 30 minutes.

The G-Sensor function of the Seat Belt Control Timer Module will cut power to the seat belt whenever:

- The vehicle accelerates or decelerates at a rate greater than or equal to 0.7g in any direction.
- The vehicle is tilted to an angle greater than or equal to 45 degrees.

Input of ignition switch in the RUN or ACCESSORY position will cause the module to power the seat belts as long as the condition exists.

The SCTM incorporates limited diagnostics. The detectable faults include solenoid shorted to ground, open or shorted to battery, internal fault, or no acceleration within the past 10 timer cycles. Faults are communicated to the seatbelt lamp via a single fault line to another module. The other module communicates the fault on the bus to the cluster/lamp.

**DIAGNOSIS AND TESTING****AIRBAG SYSTEM TEST**

(1) Connect the DRB III® scan tool to the Data Link connector which is located on the left side kick panel just above the hood release.

(2) Turn the ignition key to the ON position. Exit vehicle with the scan tool.

(3) After checking that no one is inside the vehicle, connect the battery negative remote terminal.

(4) Using the scan tool, read and record the active Diagnostic Trouble Code (DTC) data.

(5) Read and record any stored DTC's.

(6) Refer to the proper Body Diagnostic Procedures Manual if any DTC's are found in Step 4 and Step 5.

(7) Erase stored DTC's if there are no active codes. If problems remain, DTC's will not erase. Refer to the proper Body Diagnostic Procedures Manual to diagnose the problem. If the airbag warning lamp either fails to light, or goes on and stays on, there is a system malfunction. Refer to the proper Body Diagnostic Procedures Manual to diagnose the problem. To test the airbag warning lamp operation in the cluster only, refer to Group 8E, Instrument Panel and Systems.

**SEATBELT CONTROL TIMER MODULE (SCTM)**

The Seatbelt Control Timer Module (SCTM) is connected to the Body Control Module (BCM). Problems with the circuitry (Fig. 6) will be indicated by the seatbelt warning indicator lamp.

When the G-sensor is at rest, current flows to the solenoids holding them back. The seatbelt is movable.

When the sensor reacts to the force of impact, it stops current flow to the solenoids. The solenoids close in milliseconds locking the seatbelts.

The timer allows current to flow through the sensor and the solenoids for 30 minutes after the ignition is turned off. The 30-minute limit stops excessive battery drain while the engine is not running.

Connected to the Door Ajar switches, the timer closes the circuit when a door opens, and holds for 30 minutes after the door closes with the ignition off. This is necessary so the seatbelts can be managed after the ignition has been off for more than 30 minutes. Turning the key to the ACCESSORY, RUN, OR RUN/START position will also cause the timer to activate the solenoids.

**DIAGNOSTIC MODE**

For service purposes on vehicles equipped with a SCTM, the 30 minutes can be reduced to 30 seconds by following this procedure beginning with the ignition OFF, and the driver's door closed:

- Cycle the ignition switch (key ON-hey OFF) three times. Then, open and close the driver door three times.

**NOTE: If the vehicle is tilted to a 45 degree angle, or if it is subjected to acceleration or deceleration of 0.7G or more in any direction, the G-sensor will lock the seatbelts.**

**DETECTABLE FAULTS**

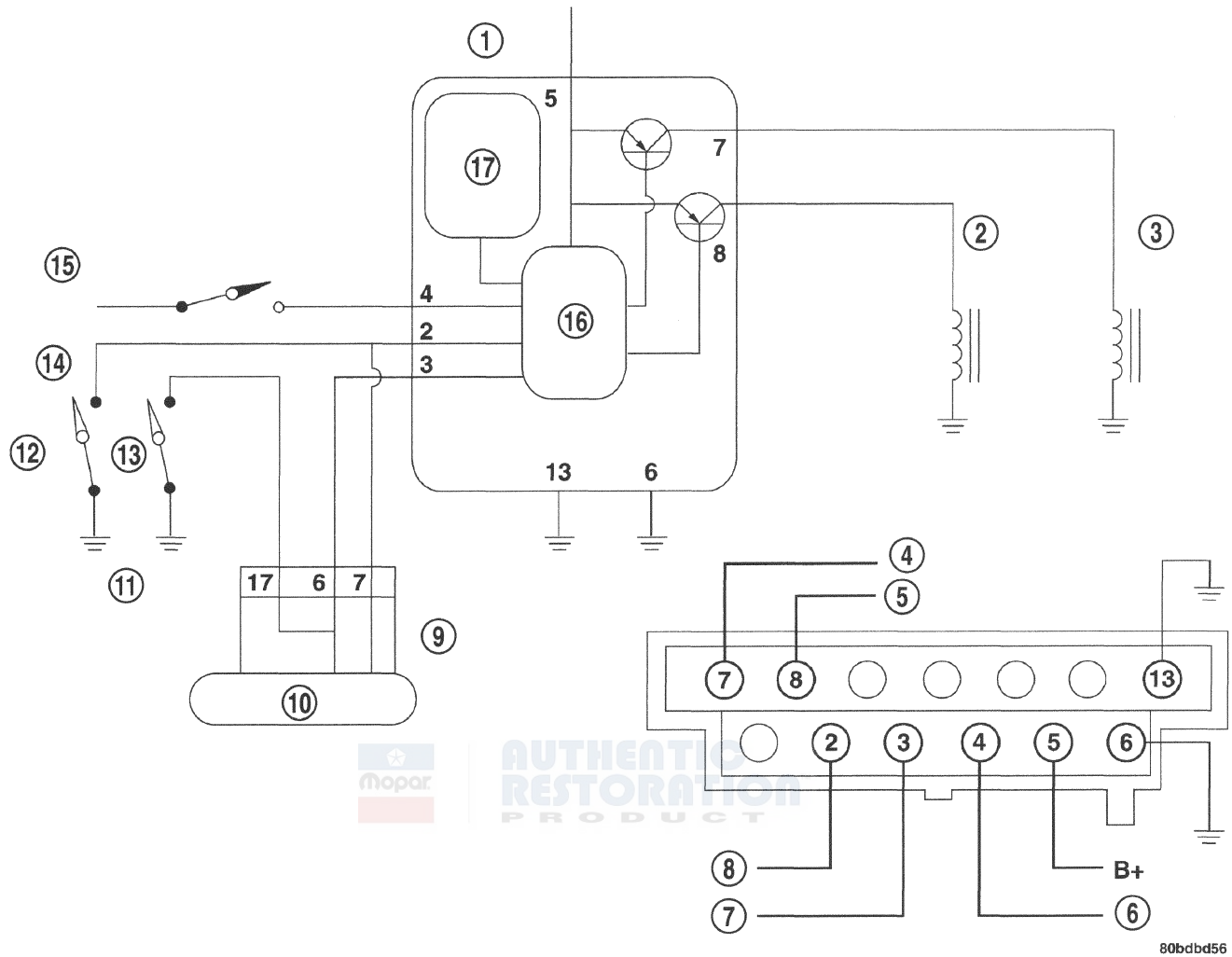
The SCTM affords limited diagnostic capability. Following is a list of detectable faults:

- Solenoid short to ground
- Solenoid Open
- Solenoid short to Battery
- No Acceleration Last Ten Timer Cycles (One Timer Cycle = Key ON plus 30 minute minimum Key OFF)

The seatbelts themselves can demonstrate problems. For example:

- Both Locked all the time
- Both locked with ignition OFF but not timed out
- Both seatbelts function properly when ignition is ON or passenger door is opened but not when driver door is opened
- Both seatbelts function properly when ignition is ON or driver door is opened but not when passenger door is opened
- Driver seatbelt locked, passenger seatbelt unlocked
- Passenger seatbelt locked, driver seatbelt unlocked

## DIAGNOSIS AND TESTING (Continued)



80bcd56

Fig. 6 Seatbelt Control Timer Module System Schematic

- 1 - BATTERY FEED
- 2 - PASS SEAT SOL.
- 3 - DR SEAT SOL.
- 4 - DR SOL.
- 5 - PASS SOL.
- 6 - IGN
- 7 - RT (PASS) DOOR
- 8 - LT (DR) DOOR
- 9 - JUNCTION BLOCK

- 10 - B. C. M.
- 11 - DOOR AJAR SWITCHES
- 12 - LT
- 13 - RT
- 14 - TN
- 15 - IGN. RUN/ACC.
- 16 - I/C
- 17 - G SENSOR

These problems can be diagnosed using a DVOM. Refer to the proper Body Diagnostic Procedures Manual.

## STRUCTURAL SEAT BELT SYSTEM CONDITIONS

Refer to Group 8W, wiring Diagrams for circuit and pin locations.

**Do Not Disconnect or Connect the module while battery is connected.**

**NOTE:** If SCTM is required to be in the "Sleep" mode for testing, remove the "Seat Belt" 20 amp maxi fuse in the PDC for (1) minute. This will allow the SCTM to time out. Reinstall fuse after (1) minute to proceed with testing.

### Both seat belts locked all the time

Turn the ignition switch to the ACCESSORY position to ensure power to the Seat Belt Control Timer Module is ON and will not time out.



**DIAGNOSIS AND TESTING (Continued)**

(1) Using a voltmeter, check for battery voltage at Pin 4 and 5 of the Seat Belt Control Timer Module 13 way connector. If no voltage, go to Step 2. If OK, go to Step 5.

(2) Check fuses:

- Fuse 13 in the Power Distribution Center
- Fuse 15 in the Junction Block

If fuses are OK, go to Step 4. If not OK, replace fuse(s), if fuse blows again go to Step 3.

(3) Disconnect Seat Belt Control Timer Module connector and replace fuse, check if fuse blows. If fuse blows check circuit for shorts to ground between the module and fuse. If OK, connect module and if fuse blows check for shorts to ground between the module and the seat belt solenoid. Repair as necessary.

(4) If voltage is OK, go to Step 5. If no voltage check for an open circuit between fuse and module. Repair as necessary.

(5) Check for voltage at the seat belt solenoid connector under the seat. If OK, test solenoid(s). If no voltage, check for open circuit between the module and seat belt connector. If OK, replace Seat Belt Control Timer Module. If not OK, repair as necessary.

**Both seat belts locked with the ignition switch in the OFF position, and SCTM not timed out**

With a door open and ensure that the timer has not timed out.

(1) Using a voltmeter, check for battery voltage at Pin 5 of the Seat Belt Control Timer Module 13 way connector. If no voltage, go to Step 2. If OK, go to Step 5.

(2) Check fuses:

- Fuse 13 in the Power Distribution Center
- Fuse 15 in the Junction Block

If fuses are OK, go to Step 4. If not OK, replace fuse(s), if fuse blows again go to Step 3.

(3) Disconnect Seat Belt Control Timer Module connector and replace fuse, check if fuse blows. If fuse blows check circuit for shorts to ground between the module and fuse. If OK, connect module and if fuse blows check for shorts to ground between the module and the seat belt solenoid. Repair as necessary.

(4) If voltage is OK, go to Step 5. If no voltage check for an open circuit between fuse and module. Repair as necessary.

(5) Using a ohmmeter check from the module connector, the door ajar switches and circuits for a open circuit and check for a shorted to ground circuit. If open or shorted circuit repair as necessary. If OK, replace Seat Belt Control Timer Module.

**Both seat belts lock and unlock with ignition switch ON or when passenger door ajar switch activated but not when the driver door ajar switch is activated.**

Using a ohmmeter, check from the module the driver door ajar switch and circuit for a open circuit and for a shorted to ground circuit. Check Pin 2 of the Seat Belt Control Timer Module to ground for continuity. If not OK, check for open or shorted circuit and repair as necessary or replace the door ajar switch. If OK, replace Seat Belt Control Timer Module. System will function improperly only from affected door.

**Both seat belts lock and unlock with ignition switch ON or when driver door ajar switch activated but not when the passenger door ajar switch is activated.**

Using a ohmmeter check from the module the passenger door ajar switch and circuit for a open or shorted circuit. Check Pin 3 of the Seat Belt Control Timer Module to ground for continuity. If not OK, check for open or shorted circuit and repair as necessary or replace the door ajar switch. If OK, replace Seat Belt Control Timer Module. System will function improperly only from affected door.

**Driver seat belt locked, passenger seat belt unlock.**

Using a ohmmeter, check the seat belt solenoid from Pin 7 of the Seat Belt Control Timer Module to ground for a reading of 50 to 60 ohms. If OK, replace Seat Belt Control Timer Module. If not OK, check for open or shorted ground circuit and repair as necessary or replace the seat belt retractor if the open or shorted circuit is in the solenoid.

**Passenger seat belt locked, driver seat belt unlock.**

Using a ohmmeter, check the seat belt solenoid from Pin 8 of the Seat Belt Control Timer Module to ground for a reading of 50 to 60 ohms. If OK, replace Seat Belt Control Timer Module. If not OK, check for open or shorted circuit and repair as necessary or replace the seat belt retractor if the open or shorted circuit is in the solenoid.

## SERVICE PROCEDURES

### CLEANUP PROCEDURE

**CAUTION:** When working around deployed Airbags, rubber gloves, eye protection and long sleeves should be worn. There may be deposits that could irritate the skin and eyes.

Roll or fold the Passenger Airbag Module towards the instrument panel surface and close the door over the folded bag. Then tape the door shut.

Use a vacuum cleaner to remove any residual powder from the vehicle interior. Work from the outside in to avoid kneeling or sitting in a contaminated area. Vacuum the heater and A/C outlets as well (Fig. 7). If the heater or air conditioner was in RECIRC mode at time of airbag deployment, operate blower motor on low speed and vacuum powder residue expelled from the heater and A/C outlets. Multiple vacuum cleaning may be necessary to decontaminate the interior of the vehicle.

**NOTE:** Dispose of deployed airbags properly. Contact dealer or government agency for disposal recommendations.

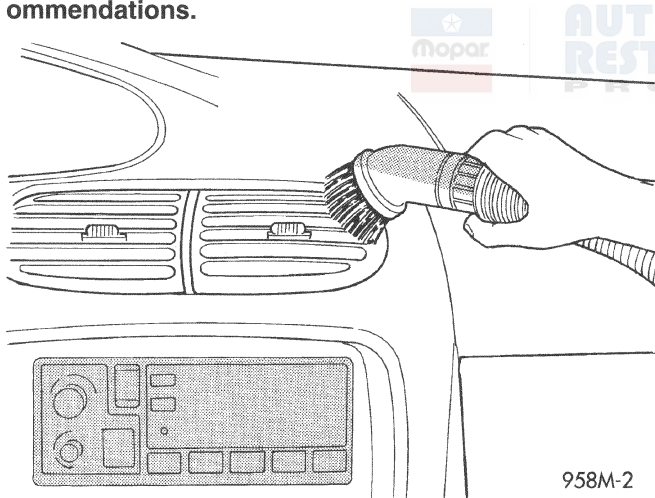


Fig. 7 Vacuum Heater and A/C Outlets

### SERVICE OF DEPLOYED AIRBAG MODULE

#### DRIVER AIRBAG

After a Driver Airbag Module has been deployed:

- Driver Airbag Module
- Steering wheel
- Clockspring assembly
- Steering Column assembly

The component above must be replaced because they cannot be reused. Replace any other driver airbag system components if damaged.

#### PASSENGER AIRBAG

After a Passenger Airbag Module has been deployed:

- Passenger Airbag Module
- Instrument panel and pad assembly

The components above must be replaced because of visible or non visible structural damage.

The glove box, top cover, cluster hood, steering column cover, right trim bezel and/or end cap, or any other components should be checked and replaced if damaged.

### HANDLING AIRBAG MODULES

#### DEPLOYED MODULE

**CAUTION:** The vehicle interior may contain a very small amount of sodium hydroxide powder, a by-product of airbag deployment. Sodium hydroxide powder can irritate the skin, eyes, nose and throat. Wear safety glasses, rubber gloves, and long sleeved clothing when cleaning any of the powder residue from the vehicle.

If you find that the cleanup is irritating your skin, run cool water over the affected area. Also, if you experience nasal or throat irritation, exit the vehicle for fresh air until the irritation ceases. If irritation continues, see a physician.

#### UNDEPLOYED

The airbag modules must be stored in its original special container until used for service. At no time should a source of electricity be permitted near the inflator on the back of an airbag module. When carrying or handling an undeployed airbag module, the trim side of the airbag should be pointing away from the body to minimize possibility of injury if accidental deployment occurs. Do not place undeployed airbag face down on a solid surface, the airbag will propel into the air if accidentally deployment occurs.

### MAINTENANCE INSPECTION

Check the airbag warning lamp for proper operation as follows:

(1) Turn the ignition switch to the ON position. The airbag warning lamp should illuminate. If does not, test the system using a DRB III® scan tool and Body Diagnostic Procedures Manual. Repair as required.

(2) The airbag warning lamp lights, but fails to go out after ten seconds. Test the system using a scan tool and Body Diagnostic Procedures Manual. Repair as required.

(3) Erasing stored Diagnostic Trouble Codes (DTC's) is not required.



## REMOVAL AND INSTALLATION

### WARNINGS AND PRECAUTIONS

**WARNING:** THIS SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE CABLE BEFORE BEGINNING AIRBAG SYSTEM COMPONENT REMOVAL OR INSTALLATION PROCEDURES. THIS WILL DISABLE THE AIRBAG SYSTEM. FAILURE TO DISCONNECT THE BATTERY COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES BEFORE REMOVING AIRBAG COMPONENTS.

DO NOT PLACE AN INTACT UNDEPLOYED AIRBAG FACE DOWN ON A SOLID SURFACE, THE AIRBAG WILL PROPEL INTO THE AIR IF ACCIDENTALLY DEPLOYED AND COULD RESULT IN PERSONAL INJURY. WHEN CARRYING OR HANDLING AN UNDEPLOYED AIRBAG MODULE, THE TRIM SIDE OF THE AIRBAG SHOULD BE POINTING AWAY FROM THE BODY TO MINIMIZE POSSIBILITY OF INJURY IF ACCIDENTAL DEPLOYMENT OCCURS.

REPLACE AIRBAG SYSTEM COMPONENTS WITH MOPAR® REPLACEMENT PARTS. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.

WEAR SAFETY GLASSES, RUBBER GLOVES, AND LONG SLEEVED CLOTHING WHEN CLEANING POWDER RESIDUE FROM VEHICLE AFTER AIRBAG DEPLOYMENT. SODIUM HYDROXIDE POWDER RESIDUE EMITTED FROM A DEPLOYED AIRBAG CAN CAUSE SKIN IRRITATION. FLUSH AFFECTED AREA WITH COOL WATER IF IRRITATION IS EXPERIENCED. IF NASAL OR THROAT IRRITATION IS EXPERIENCED, EXIT THE VEHICLE FOR FRESH AIR UNTIL THE IRRITATION CEASES. IF IRRITATION CONTINUES, SEE A PHYSICIAN.

DO NOT USE A REPLACEMENT AIRBAG THAT IS NOT IN THE ORIGINAL PACKAGING, IMPROPER DEPLOYMENT AND PERSONAL INJURY CAN RESULT.

THE FACTORY INSTALLED FASTENERS, SCREWS AND BOLTS USED TO FASTEN AIRBAG COMPONENTS HAVE A SPECIAL COATING AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. DO NOT USE SUBSTITUTE FASTENERS, USE ONLY ORIGINAL EQUIPMENT FASTENERS LISTED IN THE PARTS CATALOG WHEN FASTENER REPLACEMENT IS REQUIRED.

**NOTE:** Airbags should be stored in a cool dry location away from excessive heat and static electrical activity with the fabric airbag facing UP, or a premature deployment can result.

If the Driver/Passenger Airbag Module is defective and not deployed, refer to Chrysler Corporation current return list for proper handling procedures.

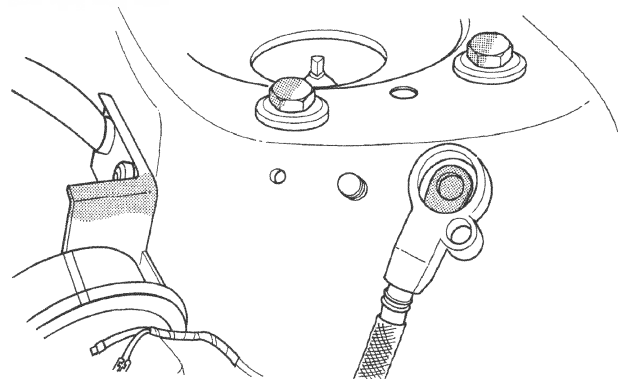
### AIRBAG CONTROL MODULE (ACM)

**WARNING:** REPLACE AIRBAG SYSTEM COMPONENTS WITH CHRYSLER MOPAR® SPECIFIED REPLACEMENT PARTS. SUBSTITUTE PARTS MAY VISUALLY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.

THE ACM CONTAINS A IMPACT SENSOR WHICH ENABLES THE SYSTEM TO DEPLOY THE AIRBAGS. TO AVOID ACCIDENTAL DEPLOYMENT, NEVER CONNECT ACM ELECTRICALLY TO THE SYSTEM WHILE VEHICLE BATTERY IS CONNECTED.

### REMOVAL

(1) Disconnect and isolate the battery negative remote cable (Fig. 8).



958A-18

**Fig. 8 Disconnect Battery Negative Remote Cable**

(2) For a manual transmission, remove shifter knob and boot.

(3) For automatic transmission models, remove shifter knob and unsnap shift indicator bezel.

(4) Remove the four attaching screws to floor console.

(5) Remove parking brake lever. Refer to Section 5-Brakes, Parking Brake Lever Removal and Installation.

(6) Remove four mounting nuts to ACM.

(7) Disconnect wire harness connectors and remove ACM from mounting studs.



## REMOVAL AND INSTALLATION (Continued)

### INSTALLATION

#### CAUTION: USE SUPPLIED NUTS ONLY.

For installation, reverse the above procedures.

(1) Position ACM (arrow pointing forward) on center tunnel area mounting studs.

(2) Attach the four mounting nuts and tighten to 15 to 19 N·m (125 to 160 in. lbs.) torque.

(3) Refer to Diagnosis and Testing for Airbag System Test procedures before connecting battery negative remote cable.

### CLOCKSPRING

#### REMOVAL

**CAUTION: When removing a deployed module, rubber gloves, eye protection and long sleeves should be worn. There may be deposits on the surface which could irritate the skin and eyes.**

(1) Disconnect and isolate the battery negative remote cable (Fig. 8).

(2) Remove the two steering column lower cover attaching screws. Remove upper cover.

(3) Remove the speed control switch screws from back of the steering wheel. Pull the switch pods out and disconnect the wires.

(4) Remove the Driver Airbag Module attaching bolts from the steering wheel. Lift the module and disconnect the wire by:

(a) Lifting the secondary latch.

(b) Disconnect the connector from back of the airbag module using the finger grips. Use care not to pull on wires. Never use a metallic tool to pry on the connector.

(5) Disconnect the horn wire from the steering wheel and remove the speed control wires from the wire guides.

(6) Remove the steering wheel. Carefully feed all wires through the steering wheel armature to avoid damaging wires. When replacing a deployed Driver Airbag Module, a new clockspring must be installed (Fig. 9).

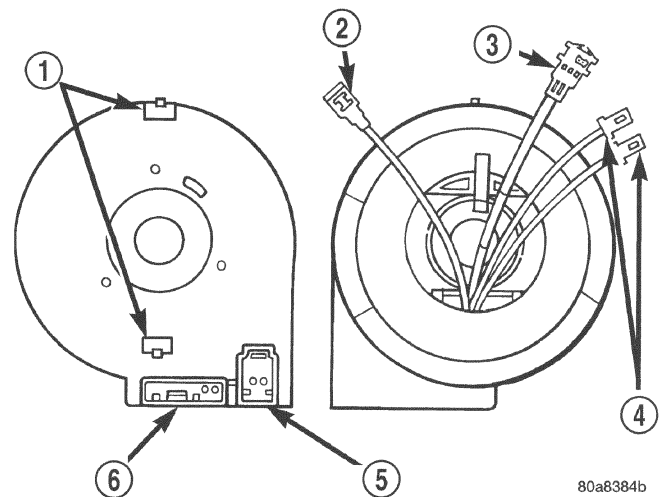
(7) Remove the nut attaching steering wheel to the steering column.

(8) Disconnect the natural 3-way and the yellow 2-way connectors from back side of the Driver Airbag Module.

(9) Remove the steering column shrouds by unfastening the two fasteners.

(10) Remove multi-function switch by unfastening the two screws.

(11) Remove the clockspring by lifting the top lock housing latches up slightly to guide it over the lock housing. The clockspring cannot be serviced.



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**Fig. 9 Clockspring**

- 1 - LOCK HOUSING LATCHES
- 2 - HORN WIRE
- 3 - SQUIB WIRE
- 4 - SPEED CONTROL WIRES
- 5 - 2-WAY CONNECTOR
- 6 - 4-WAY CONNECTOR

#### INSTALLATION

(1) Adjust the steering wheel so that the tires are straight ahead position.

(2) Center the clockspring by ensuring the yellow indicator visually seen through the centering window. Refer to Clockspring Centering Procedure.

(3) Align the top locking tab with the slot on the lock housing. Gently push into place.

(4) Install the multi-function switch and tighten to 1.5 to 2.5 N·m (14 to 22 in. lbs.) torque.

(5) Install the steering column shrouds and tighten to 1.7 to 2.3 N·m (15 to 20 in. lbs.) torque.

(6) Carefully route the wires through the hole in the steering wheel armature. Install steering wheel and Tighten to 61 N·m (45 ft. lbs.) torque.

(7) Route the speed control wires under the horn mechanism and through the speed control switch pockets. Connect the speed control wires to switches and install switches. Tighten screws to 0.7 to 2.7 N·m (6 to 24 in. lbs.) torque.

(8) Connect horn lead to the airbag module mounting bracket.

(9) Connect the yellow airbag lead to the Driver Airbag Module and push secondary latch into place (Fig. 9). Ensure the wires do not get pinched during installation.

(10) Install the airbag module bolts and tighten to 9 to 10 N·m (80 to 90 in. lbs.) torque. Refer to Diagnosis and Testing for Airbag System Test procedures before connecting the battery negative remote cable.

**REMOVAL AND INSTALLATION (Continued)****DRIVER AIRBAG MODULE****REMOVAL**

**CAUTION:** When removing a deployed Driver Airbag Module, rubber gloves, eye protection and long sleeves should be worn. There may be deposits on the surface that could irritate the skin and eyes.

- (1) Disconnect and isolate the battery negative remote cable (Fig. 8).
- (2) Remove the speed control switch screws from back of the steering wheel. Pull the switch pods out and disconnect the wires.
- (3) Remove the Driver Airbag Module attaching bolts from the steering wheel. Lift the module and disconnect the wire by:
  - (a) Lifting the secondary latch.
  - (b) Disconnect the connector from back of the Driver Airbag Module using the finger grips. Use care not to pull on wires. Never use a metallic tool to pry off the connector.
- (4) Disconnect the horn wire from the airbag mounting bracket. Remove the speed control wires from the wire guides.
- (5) When replacing a deployed Driver Airbag Module, the clockspring must also be replaced. Refer to Clockspring Removal and Installation in this section.

**INSTALLATION**

- (1) Connect horn wire to the Driver Airbag Module mounting bracket. Connect the Driver Airbag Module connector to the back of the module. Make airbag connection by pressing straight in on the connector then push the secondary latch into place. The connector should be fully seated to ensure a positive connection. Ensure that the wires do not get pinched during installation.
- (2) Install the two module bolts and tighten to 9 to 10 N·m (80 to 90 in. lbs.) torque.
- (3) Connect wire connectors to the speed control switches and install the switches. Tighten the screws to 0.7 to 2.7 N·m (6 to 24 in. lbs.). Refer to Diagnosis and Testing for Airbag System Test procedures before connecting the battery negative remote cable.

**PASSENGER AIRBAG MODULE****DEPLOYED MODULE**

**CAUTION:** When removing a deployed Passenger Airbag Module, rubber gloves, eye protection and long sleeves should be worn. There may be deposits on the surface that could irritate the skin and eyes.

**REMOVAL**

- (1) Remove Instrument Panel. Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.
- (2) After removal of the instrument panel disconnect Passenger Airbag Module wire connector.
- (3) Remove the four nuts and two screws attaching airbag assembly to the instrument panel collar.
- (4) Lift Passenger Airbag Module up and out of panel cavity.

**INSTALLATION**

- For installation, reverse the above procedures.
- (1) Remove all of the instrument panel components that are not damaged and replace any components that are damaged.
  - (2) **Use a new Instrument Panel and Pad Assembly.**
  - (3) Transfer all of the components.
  - (4) **Install a new Passenger Airbag Module** and tighten nuts to 11 N·m (100 in. lbs.) and screws to 2 N·m (20 in. lbs.) torque. Refer to Diagnosis and Testing for Airbag System Test procedures before connecting battery negative remote cable.

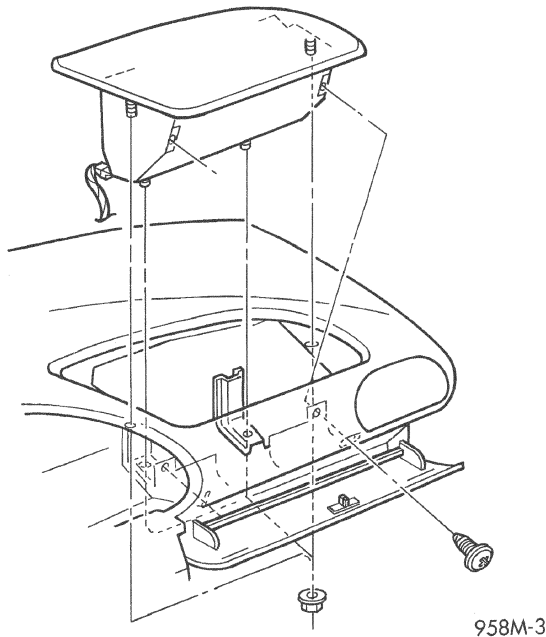
**UNDEPLOYED MODULE****REMOVAL**

When removing a Passenger Airbag Module for any reason other than DEPLOYMENT:

- (1) Disconnect and isolate the battery negative remote cable (Fig. 8).
- (2) Open and lower glove box fully to gain access to Passenger Airbag Module (PAB) attaching screws inside of the glove box (Fig. 10). Glove box removal not required.
- (3) Disconnect wire connector from the Passenger Airbag Module.
- (4) Remove the four nuts and two screws attaching airbag assembly to the instrument panel collar.
- (5) Lift Passenger Airbag Module up and out of panel cavity.

**INSTALLATION**

For installation, reverse the above procedures. Install a new Passenger Airbag Module and tighten nuts to 11 N·m (100 in. lbs.) and screws to 2 N·m (20 in. lbs.) torque. Refer to Diagnosis and Testing for Airbag System Test procedures before connecting battery negative remote cable.

**REMOVAL AND INSTALLATION (Continued)****Fig. 10 Passenger Airbag Removal****SEATBELT CONTROL TIMER MODULE (SCTM)**

**CAUTION: DO NOT CONNECT OR DISCONNECT THE SEATBELT CONTROL TIMER MODULE (SCTM) WHILE THE BATTERY IS CONNECTED. FAILURE TO DO THIS MAY RESULT IN PERSONAL INJURY OR PROPERTY DAMAGE AS A CONSEQUENCE OF IMPROPER OPERATION OF THE MODULE.**

**REMOVAL**

- (1) Disconnect and isolate the battery negative remote cable.
- (2) Raise parking brake lever as high as possible.
- (3) Loosen set screw on front of shifter knob and remove shift lever knob.
- (4) Remove plastic plunger rod from shifter lever.
- (5) Remove cap covering screw head near shifter lever.
- (6) Remove lighted PRNDL bezel.
- (7) Remove screws next to floor shifter and in console storage compartment, holding floor console to the brackets on the floor pan.
- (8) Disconnect wire connector for floor console accessories at floor pan.
- (9) Separate console from vehicle.
- (10) Remove the two mounting nuts from the Seatbelt Control Timer Module.
- (11) Remove the wire harness connector from the module and remove module.

**INSTALLATION****CAUTION: USE SUPPLIED NUTS ONLY**

- (1) Install the module and tighten the mounting nuts to the proper torque.
- (2) Position console in vehicle.
- (3) Verify that the rear locator pin on the bottom of the storage bin is engaged to the slot in the body bracket.
- (4) Connect the wire connector for the floor console accessories at floor pan.
- (5) Install lighted PRNDL letter bezel.
- (6) Install cap to cover screw head near shifter lever.
- (7) Install plastic plunger rod to shifter lever.
- (8) Install shift lever knob and tighten set screw on front of shifter knob.

**STEERING WHEEL****REMOVAL**

- (1) Adjust the steering wheel so that the tires are in the straight ahead position.
- (2) Disconnect and isolate the battery negative remote cable (Fig. 8).
- (3) Remove the speed control switch screws from back of the steering wheel. Pull the switch pods out and disconnect the wires.
- (4) Remove the Driver Airbag Module attaching bolts from steering wheel. Lift the module and disconnect the wire by:
  - (a) Lifting the secondary latch.
  - (b) Disconnect the connector from the module using the finger grips. Use care not to pull on wires. Never use a metallic tool to pry on the connector.
- (5) Disconnect the horn wire from the airbag module mounting bracket. Remove the speed control wires from under the bracket and from the wire guides.
- (6) Remove the steering wheel retaining nut.
- (7) Remove the steering wheel with wheel puller tool. Carefully feed all of the wires through the steering wheel armature to avoid damaging wires.

**INSTALLATION**

- (1) Ensure that the road wheels are in the straight ahead position.
- (2) Ensure that the clockspring is centered by using the centering indicator. Refer to Clockspring Centering Procedure in this section.
- (3) Ensure that the turn signal stalk is in the neutral position.



**REMOVAL AND INSTALLATION (Continued)**

(4) Carefully route the wires through the hole in the steering wheel armature. Install steering wheel and tighten to 61 N·m (45 ft. lbs.) torque.

(a) Ensure that the driving key on the steering wheel hub lines up with the slot in the clockspring rotor.

(b) Ensure that the block tooth in the steering wheel hub lines up with the missing tooth on the steering column shaft.

(5) Route the speed control wires under the horn mechanism and through the speed control switch pockets. Connect the speed control wires to switches and install switches. Tighten bolts to  $1.7 \pm 1$  N·m (15  $\pm$  10 in. lbs.) torque.

(6) Connect the horn lead to steering wheel.

(7) Connect the yellow airbag lead to the Driver Airbag Module and push secondary latch into place (Fig. 9). Check that the wires do not get pinched during installation.

(8) Install the airbag module bolts and tighten the left side first. Tighten to 9 to 10 N·m (80 to 90 in. lbs.) torque.

(9) Refer to Diagnosis and Testing for Airbag System Test procedures before connecting battery negative remote cable.

**ADJUSTMENTS****CLOCKSPRING CENTERING PROCEDURE**

**WARNING:** If the rotating tape within the clockspring is not positioned properly with the steering wheel and the front wheels, the clockspring may fail during use. The clockspring is centered when yellow appears in the centering window and the arrow on the rotor points to the window. If clockspring is not centered, the following procedure **MUST BE USED** to center the clockspring:

(1) To center the clockspring, with steering wheel removed, depress the two plastic locking pins to disengage the mechanism. Rotate clockspring until yellow appears in the centering window.

(2) The arrow on the rotor will be pointing at the window if the clockspring is centered. Release locking pins to engage locking mechanism.

(3) For installation, refer to Clockspring Removal and Installation in this section. Refer to Diagnosis and Testing for Airbag System Test procedures before connecting battery negative remote cable.



**AUTHENTIC  
RESTORATION™**  
PRODUCT

# ELECTRICALLY HEATED SYSTEMS

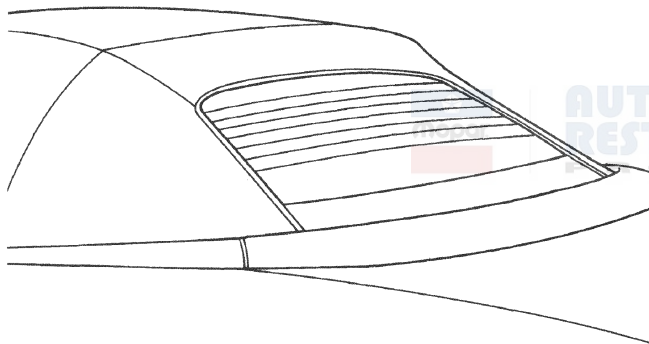
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## DESCRIPTION AND OPERATION

### REAR WINDOW DEFOGGER SYSTEM

#### DESCRIPTION



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**Fig. 1 Rear Window Defogger**

The rear window defogger is used to defog and deice the rear window in cases of freeze up and humid conditions. The switch is located within the mode select knob on the HVAC control module.

#### OPERATION

The system consists of a rear glass with two vertical bus bars and a series of electrically connected grid lines on the inside surface. The control switch is located in the HVAC Control Module. The relay is located in the junction block. The timer is located in the Body Control Module (BCM).

Circuit protection for heated grid is provided by:

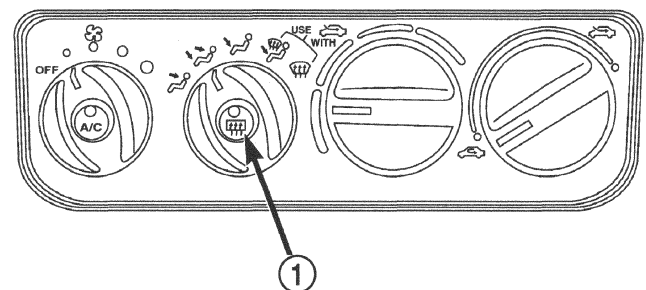
- Fuse 12 (EBL) located in the power distribution center
- Rear window defogger relay (EBL) located in the Junction Block

When the button is depressed to the ON position, current is directed to the rear defogger grid lines. A yellow indicator within the center of the button will illuminate while the defogger is ON. The heated grid lines will heat the rear glass and clear the window surface of fog or frost.

**CAUTION:** Grid lines can be damaged or scraped off with sharp instruments, care should be taken in cleaning glass or removing foreign materials, decals or stickers. Normal glass cleaning solvents or hot water used with rags or toweling is recommended.

## HVAC CONTROL MODULE

### DESCRIPTION



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**Fig. 2 HVAC Control Module**

1 - REAR WINDOW DEFOGGER SWITCH

The rear window control switch and circuit are integrated into the HVAC control module.

**DESCRIPTION AND OPERATION (Continued)****OPERATION**

When actuating the switch it sends a ground signal to the Body Control Module (BCM). The BCM actuates the relay allowing current to flow through the grid lines for ten minutes upon initial actuation. Then 5 minutes with each subsequent actuation or until either the switch or ignition is turned off. An indicating lamp illuminates the rear window defogger switch.

**DIAGNOSIS AND TESTING****SYSTEM TEST**

Electrically heated rear window defogger operation can be checked in vehicle in the following manner:

(1) Turn ignition switch to the ON position.  
 (2) Make sure defogger switch is OFF.  
 (3) Remove the battery negative remote cable from the terminal. Using a ammeter (capable of a 30 AMP range), connect the ammeter in series between the battery cable and the remote terminal. Turn the Defogger control switch ON, a distinct increase in amperage draw should be noted.

(4) The rear window defogger operation can be checked by feeling the glass. A distinct difference in temperature between the grid lines and adjacent clear glass can be detected in 3 to 4 minutes of operation.

(5) Using a DC voltmeter (Fig. 3) contact terminal B with the negative lead, and terminal A with the positive lead. The voltmeter should read 10-14 volts.

(6) Step 3, Step 4, and Step 5 above will confirm system operation. Indicator light illumination means that there is power available at the output of the relay only, and does not necessarily verify system operation.

(7) If the indicator light is not on, then check fuse #6 in the junction block.

(8) If turning the switch ON produced no distinct current draw on the ammeter the problem should be isolated in the following manner:

(a) Confirm the ignition switch is ON.

(b) Ensure that the heated rear glass feed wire is connected to the terminal or pigtail and that the ground wire is in fact grounded.

(c) Ensure that fuse 12 (EBL) in the Power Distribution Center is OK.

(9) When the above steps have been completed and the system is still inoperative, one or more of the following is defective:

(a) Control switch in the HVAC control module

(b) Rear window defogger relay (EBL) in the Junction Block

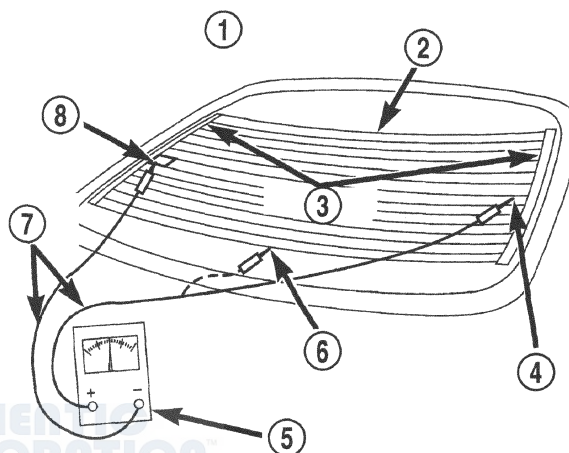
(c) Timer circuit in the Body Control Module

(d) Rear window grid lines, all grid lines would have to be broken or one of the feed wires are not connected for the system to be inoperative.

(10) If depressing the switch button ON produces severe voltmeter deflection, the circuit should be closely checked for a shorting condition.

(11) If the system operation has been verified but indicator bulb does not light, check fuse 6 in the junction block. If not OK, replace as necessary. If OK, test the HVAC control module.

(12) For detailed wiring information, refer to group 8W, Wiring Diagrams.



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**Fig. 3 Grid Line Test**

- 1 - VIEW FROM INSIDE VEHICLE
- 2 - REAR WINDOW DEFOGGER
- 3 - BUS BARS
- 4 - VOLTAGE FEED (A)
- 5 - VOLTMETER
- 6 - MID-POINT (C)
- 7 - PICK-UP LEADS
- 8 - GROUND (B)

**GRID LINES**

The horizontal grid lines and vertical bus bar lines printed and fired on inside surface of rear window glass (Fig. 3) comprise an electrical parallel circuit. The electrically conductive lines are composed of a silver-ceramic material which when fired on glass becomes bonded to the glass and is highly resistant to abrasion. It is possible, however, that a break may occur in an individual grid line resulting in no current flow through the line. To detect breaks in grid lines the following procedure is required:

(1) Turn ignition switch to the ON position. Depress the control switch button to ON position. The indicator light should come on.

(2) Using a DC voltmeter with 0-15 volt range, contact the ground terminal with negative lead of voltmeter. With positive lead of voltmeter, contact feed terminal (Fig. 3). The voltmeter should read



## DIAGNOSIS AND TESTING (Continued)

10-14 volts. A lower voltage reading indicates a poor ground connection.

(3) Connect the negative lead of voltmeter to a good body ground point. The voltage reading should not be more than two tenth of a volt difference. If more than two tenth of a volt repair the ground circuit.

(4) Connect negative lead of voltmeter to ground terminal and touch each grid line at Mid-Point with Positive lead. A reading of approximately 6 volts indicates a line is good. A reading of 0 volts indicates a break in line between Mid-Point and feed terminal. A reading of 10-14 volts indicates a break between Mid-Point and ground terminal. Move toward break and voltage will change as soon as break is crossed (Fig. 3). Refer to Group 8W, Wiring Diagrams for circuit information.

## HVAC CONTROL MODULE

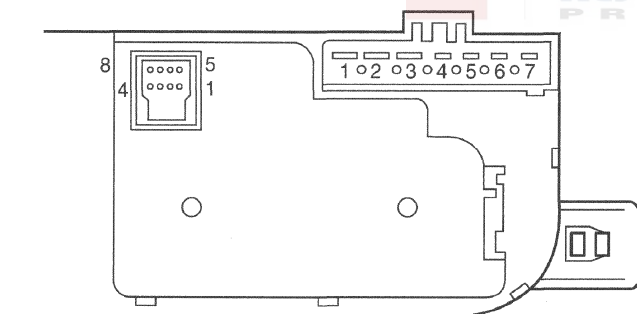
The control switch and timer circuit may be tested in the vehicle with or without the DRB III® scan tool.

### TESTING WITH DRB III® SCAN TOOL

If using the DRB III® scan tool, refer to the proper Body Diagnostic Procedures Manual.

### TESTING WITHOUT DRB III® SCAN TOOL

(1) Remove the control switch from console and do not disconnect control switch (Fig. 4).



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**Fig. 4 HVAC Control Module Connectors**

(2) Using an ohmmeter, check leads between Pins 5 and 8 of the 8-way connector. Depress the rear window defogger button and the resistance reading should be 500 to 520 ohms. If not OK, replace HVAC. If OK, check:

- Rear window relay (EBL)
- Blown fuse
- Cut wire
- Poor ground
- Poor connection
- Defective BCM
- Bulkhead connector inoperative

Refer to Group 8W, Wiring Diagrams.

## REAR WINDOW DEFOGGER RELAY

(1) Check fuses.

(a) Fuse 15 in the Junction Block

(b) Fuse 8 and 12 in the Power Distribution Center.

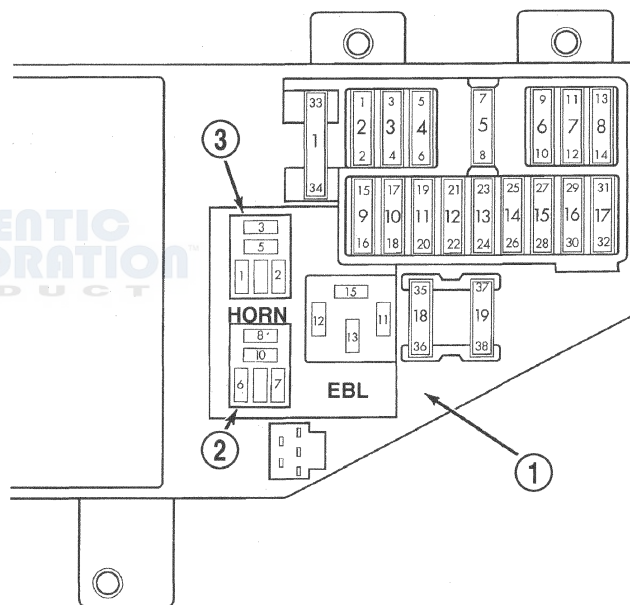
(2) Remove the rear window defogger relay (EBL) from the Junction Block (Fig. 5).

(3) Using voltmeter, test battery voltage:

(a) Test rear window defogger relay terminals 13 for battery voltage. If voltage is OK, go to Step b. If voltage is not OK, repair A4 circuit.

(b) Test the rear window defogger relay terminal for battery voltage with the key in the run position. If voltage is OK, go to Step c. If voltage is not OK, repair A31circuit.

(c) Use a known good relay. If not OK, repair circuits as necessary. Refer to Group 8W, Wiring Diagrams. If OK, replace relay.



**Fig. 5 Rear Window Defogger Relay (EBL)**

- 1 - CIRCUIT BREAKERS
- 2 - HORN RELAY
- 3 - H/LP RELAY

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## SERVICE PROCEDURES

### REPAIR GRID LINES, TERMINALS AND PIGTAILS

**WARNING: REPAIR KIT MAY CAUSE SKIN OR EYE IRRITATION.**

**THE KIT CONTAINS EPOXY RESIN AND AMINE TYPE HARDENER AND HARMFUL:**

- DO NOT TAKE INTERNALLY, IF SWALLOWED INDUCE VOMITING AND CALL A PHYSICIAN IMMEDIATELY.

- IF CONTACTED WITH SKIN, WASH AFFECTED AREAS WITH SOAP AND WATER.

- IF CONTACTED WITH EYES, FLUSH WITH PLENTY OF WATER.

**USE WITH ADEQUATE VENTILATION.**

**DO NOT USE NEAR FIRE OR OPEN FLAME THE CONTENTS CONTAIN FLAMMABLE SOLVENTS.**

**KEEP OUT OF REACH OF CHILDREN.**

The repair of the grid lines or the terminal is possible using the Mopar® Repair Package or equivalent.

(1) Mask repair area so conductive epoxy can be extended onto the line or the bus bar (Fig. 6).

(2) Follow instructions in repair kit for preparing damaged area.

(3) Remove package separator clamp and mix plastic conductive epoxy thoroughly. Fold in half and cut center corner to dispense epoxy.

(4) Apply conductive epoxy through slit in masking tape. Overlap both ends of the break by 19 mm (3/4 inch).

(5) For a terminal or pigtail replacement, mask adjacent areas so epoxy can be extended onto line as well as bus bar. Apply a thin layer of epoxy to area where terminal was fastened and to adjacent line.

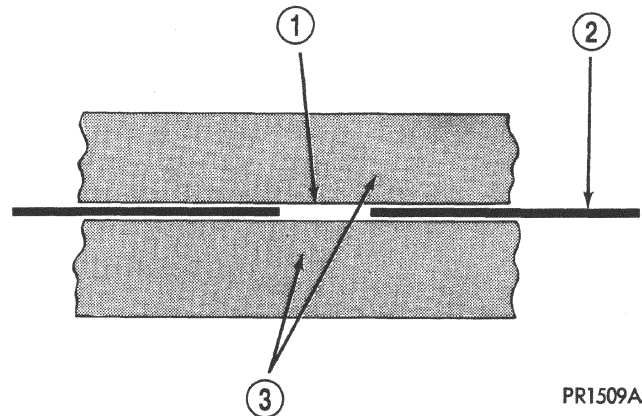
(6) Apply a thin layer of conductive epoxy on terminal and place terminal on desired location. To prevent terminal from moving while the epoxy is curing, it must be wedged or clamped.

(7) Carefully remove masking tape from grid line.

**CAUTION: Do not allow the glass surface to exceed 204°C (400°F), glass may fracture.**

(8) Allow epoxy to cure 24 hours at room temperature or use heat gun with a 260° to 371°C (500° to 700°F) range for 15 minutes. Hold gun approximately 254 mm (10 inches) from repaired area.

(9) After conductive epoxy is properly cured remove wedge from terminal and check out operation of rear window defogger. Do not attach connectors until curing is complete.



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**Fig. 6 Grid Line Repair**

- 1 - BREAK
- 2 - GRID LINE
- 3 - MASKING TAPE

## REMOVAL AND INSTALLATION

### HVAC CONTROL

Refer to Group 8E, Instrument Panel and Systems for proper Removal and Installation procedures.

### REAR WINDOW DEFOGGER RELAY

(1) Disconnect and isolate the battery negative remote cable.

(2) Open the driver's door and remove instrument panel end cover.

(3) Remove Rear Window Defogger (EBL) relay from the Junction Block (Fig. 5).

# POWER DISTRIBUTION SYSTEMS

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## DESCRIPTION AND OPERATION

### POWER DISTRIBUTION SYSTEM

#### DESCRIPTION

This group covers the various standard and optional power distribution components used on this model. Refer to the Component Index of Group 8W - Wiring Diagrams for complete circuit diagrams of the various power distribution components.

#### OPERATION

The power distribution system for this vehicle is designed to provide safe, reliable, centralized and convenient to access distribution of the electrical current required to operate all of the many standard and optional factory-installed electrical and electronic powertrain, chassis, safety, comfort and convenience systems. At the same time, these systems were designed to provide centralized locations for conducting diagnosis of faulty circuits, and for sourcing the additional current requirements of many aftermarket vehicle accessory and convenience items.

These power distribution systems also incorporate various types of circuit control and protection features, including:

- Fuses
- Fuse cartridges
- Fusible links
- Automatic resetting circuit breakers
- Relays
- Flashers
- Timers
- Circuit splice blocks.

The power distribution system for this vehicle consists of the following components:

- Power Distribution Center (PDC)
- Junction Block (JB)
- Accessory power outlet.

Following are general descriptions of the major components in the power distribution system. Refer to the owner's manual in the vehicle glove box for

more information on the features, use and operation of all of the power distribution system components.

### POWER DISTRIBUTION CENTER (PDC)

#### DESCRIPTION

All of the electrical current distributed throughout this vehicle is directed through the standard equipment Power Distribution Center (PDC). The molded plastic PDC housing is located in the left front corner of the engine compartment, just behind the battery. The PDC housing has a molded plastic cover that includes an integral hinge feature on the inboard side, and an integral latch on the outboard side. The PDC cover is easily removed for service access and has a convenient fuse and relay layout label affixed to the inside surface of the cover to ensure proper component identification.

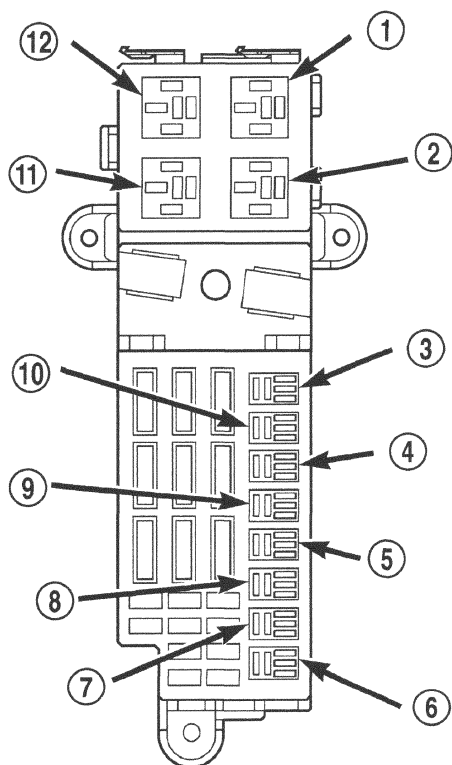
The PDC housing is secured in the engine compartment on the left front corner with three screws to the transmission and engine control module bracket. A small red molded plastic protective cover on the top near the rear of the PDC is unsnapped to access the battery/generator cable input connection stud. All of the PDC outputs are through the integral engine compartment wire harness, which exits from the rear of the PDC housing.

#### OPERATION

All of the current from the battery/generator cable connection enters the PDC through a 140 ampere fusible link that is secured to the top of the PDC housing. The PDC houses up to ten maxi-fuse cartridges, which replace all in-line fusible links. The PDC also houses up to eight blade-type fuses, up to four full International Standards Organization (ISO) relays, and up to eight ISO micro-relays. Internal connection of all the PDC circuits is accomplished by an intricate network of hard wiring and bus bars. Refer to **Power Distribution** in the Component Index of Group 8W - Wiring Diagrams for complete circuit diagrams.



## DESCRIPTION AND OPERATION (Continued)

**Fig. 1 Power Distribution Center (PDC)**

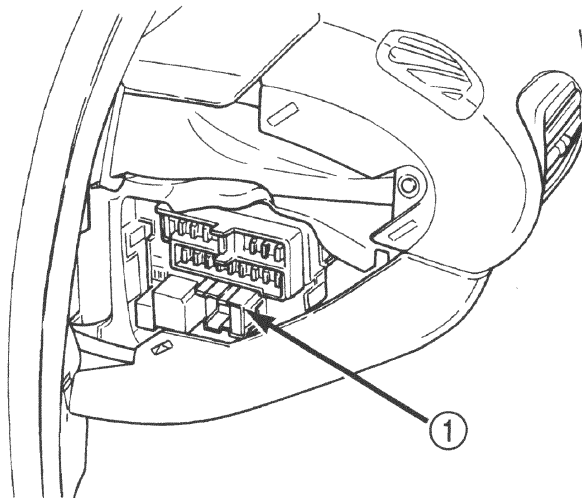
- 1 - LOW SPEED RADIATOR FAN RELAY (11)
- 2 - ENGINE STARTER MOTOR RELAY (9)
- 3 - NOT USED (8)
- 4 - POWER TOP INHIBIT (6)
- 5 - HI/LO WIPER RELAY (4)
- 6 - NOT USED (1)
- 7 - TRANSMISSION CONTROL RELAY (2)
- 8 - FUEL PUMP RELAY (3)
- 9 - INTERMITTENT WIPER RELAY (5)
- 10 - A/C COMPRESSOR CLUTCH RELAY (7)
- 11 - AUTOMATIC SHUTDOWN RELAY (10)
- 12 - HIGH SPEED RADIATOR FAN RELAY (12)

The fusible link, fuse cartridges, fuses and relays are available for service replacement. The PDC unit cannot be repaired and is only serviced as a unit with the engine compartment wire harness. If the PDC is faulty or damaged, the engine compartment wire harness assembly must be replaced.

## JUNCTION BLOCK (JB)

### DESCRIPTION

An electrical Junction Block (JB) is located in the left endcap of the instrument panel. The JB combines the functions previously provided by a separate fuseblock module and relay center. It also serves to simplify and centralize numerous electrical components, as well as to distribute electrical current to many of the accessory systems in the vehicle. It eliminates the need for



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**Fig. 2 Junction Block Location**

1 - JUNCTION BLOCK

numerous splice connections and serves in place of a bulkhead connector between many of the engine compartment, instrument panel, and body wire harnesses.

The JB is positioned on a mounting bracket up and under the left instrument panel. It is secured by three screws. The JB is concealed behind the left instrument panel endcap. The left instrument panel endcap is a snap-fit fuse access cover that conceals the JB fuses. A fuse puller and spare fuse holders are located on the back of the endcap, as well as the fuse layout to ensure proper fuse identification. The left instrument panel endcap must be removed to access components other than the fuses in the JB.

### OPERATION

All of the current entering and leaving the JB does so through wire harnesses, which are connected to the JB through integral connector receptacles molded into the JB housing. The JB houses blade-type fuses, blade-type automatic resetting circuit breakers, full International Standards Organization (ISO) relays, and ISO micro-relays. Internal connection of all the JB circuits is accomplished by an intricate network of hard wiring and bus bars. Refer to **Junction Block** in the Component Index of Group 8W - Wiring Diagrams for complete circuit diagrams.

The fuses, circuit breakers, relays, and are available for service replacement. The JB unit cannot be repaired and is only serviced as an assembly. If any internal circuit or the JB housing is faulty or damaged, the entire Junction Block assembly must be replaced.

## REMOVAL AND INSTALLATION

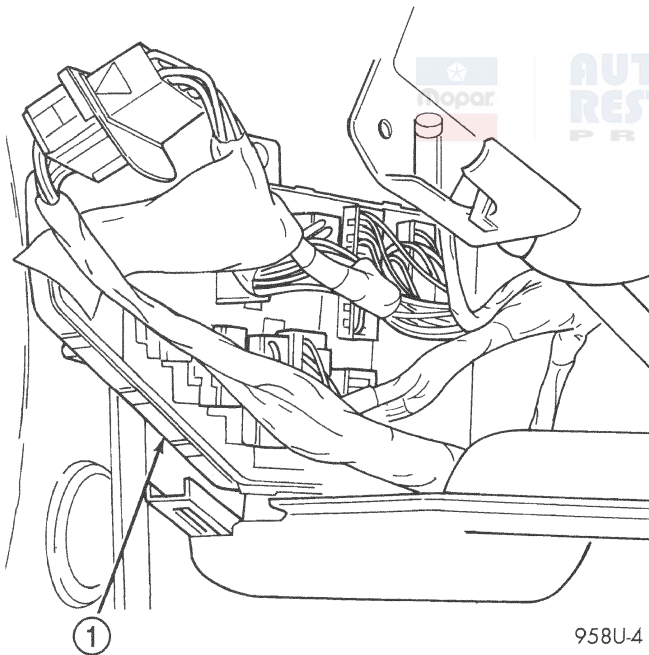
### JUNCTION BLOCK (JB)

#### REMOVAL

**WARNING: ON VEHICLES EQUIPPED WITH AIR-BAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIR-BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**

The Junction Block (JB) and Body Control Module (BCM) are attached to each other. After removal they can be separated. Junction Block and Body Control Module assemblies are located on the driver's side of the vehicle (Fig. 3).

connectors are in good condition and connectors are properly installed.



**Fig. 3 Junction Block/BCM Location**

1 - JUNCTION/BCM

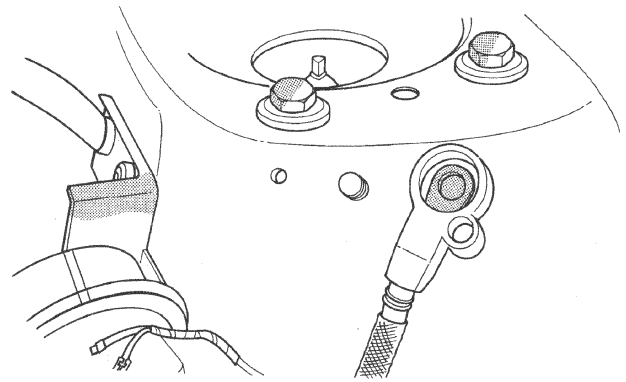
(1) Open hood then disconnect and isolate the battery negative remote cable from the remote terminal on the left shock tower (Fig. 4).

(2) Open the front driver's door and remove end cap.

(3) Remove center bezel.

(4) Remove instrument cluster hood.

(5) Remove silencer.



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**Fig. 4 Battery Negative Remote Cable**

(6) Remove wire harness connectors from Junction Block.

(7) Remove Junction Block three mounting screws.

(8) Remove Junction Block/BCM by pulling straight down from the mounting bayonet.

(9) Disconnect BCM wire connectors and remove the assembly.

(10) Remove Junction Block/BCM from vehicle.

(11) With the Junction Block/BCM removed from the vehicle, separate the BCM from the Junction Block.

(12) Remove the two BCM attaching screws and release the two BCM locking latches from the Junction Block.

(13) Disconnect BCM from the Junction Block.

#### INSTALLATION

For installation, reverse the above procedures. Ensure that the wire terminals and connectors are in good condition and connectors are properly installed.

### POWER DISTRIBUTION CENTER

The Power Distribution Center (PDC) is serviced as a unit with the engine compartment wire harness. If any internal circuit of the PDC or the PDC housing is faulty or damaged, the entire PDC and engine compartment wire harness unit must be replaced.

#### REMOVAL

(1) Open hood then disconnect and isolate the battery negative remote cable from the remote terminal on the left shock tower (Fig. 4).

(2) Remove the Air Inlet System (housing and resonator). Refer to Group 14, Fuel System for Removal and Installation.

(3) Disconnect each of the engine compartment wire harness connectors. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the locations of the affected connectors.

**REMOVAL AND INSTALLATION (Continued)**

(4) Remove the fasteners that secure each of the engine compartment wire harness ground eyelets to the vehicle body and chassis components. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the ground eyelet locations.

(5) Disengage each of the retainers that secure the engine compartment wire harness to the vehicle body and chassis components. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the retainer locations.

(6) Remove the three screws retaining the PDC to its mounting bracket.

(7) Remove the PDC and the engine compartment wire harness from the engine compartment as a unit.

**INSTALLATION**

**NOTE:** If the power distribution center is being replaced with a new unit, be certain to transfer each of the fuses, fuse cartridges, fusible links and relays from the old power distribution center to the proper cavities of the new power distribution center. Refer to Power Distribution in Group 8W - Wiring Diagrams for the proper power distribution center cavity assignments.

(1) Position the PDC over the mounting bracket between the Powertrain and Transmission Control Modules in the engine compartment.

(2) Align the PDC mounting slots with the blades on the PDC mounting bracket.

(3) Install the three mounting screws into the PDC.

(4) Route the engine compartment wire harness from the PDC through the engine compartment, engaging each of the harness retainers to the mounting provisions in the vehicle body and chassis components. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the harness routing and retainer locations.

(5) Install and tighten the fasteners that secure each of the engine compartment wire harness ground eyelets to the vehicle body and chassis components. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the ground eyelet locations. See the table below for the proper fastener tightness values.

(6) Reconnect each of the engine compartment wire harness connectors. Refer to **8W-90 - Connector Locations** in Group 8W - Wiring Diagrams for more information on the locations of the affected connectors.

(7) Reconnect the battery negative remote cable (Fig. 4) to the remote terminal on the left strut tower.



# POWER LOCK SYSTEMS

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## POWER DOOR LOCKS

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## DESCRIPTION AND OPERATION

### POWER DOOR LOCK SYSTEM

#### DESCRIPTION

The power lock system allows both doors to be locked or unlocked electrically by operating the switch on either front door trim panel. The power lock system operates on non-switched battery current supplied through a fuse in the junction block so that the system remains functional, regardless of the ignition switch position.

#### OPERATION

The doors can be locked or unlocked electrically by operating the switch on either front door panels or with the locking knobs from within the vehicle.

The doors can be locked or unlocked mechanically from the outside with the key or electrically by using the Key Fob Transmitter. Both front doors can also be unlocked by actuation of the inside remote door handle.

## AUTOMATIC DOOR LOCKS

#### DESCRIPTION

The system includes an automatic door locking feature actuated by the Body Control Module (BCM). **The vehicle is built with the system enabled.**

The BCM will automatically lock all doors when all of the conditions below are met:

- All doors are closed
- The vehicle speed exceeds  $15 \pm 1$  M. P. H.
- The throttle position sensor tip-in is greater than  $10 \pm 2$  degrees

When the system is disabled the door locks will work by use of the door lock switches only. When this system is enabled the automatic door locks will work automatically.

#### OPERATION

The BCM controls the power locks when the door lock switch is activated. If the door lock switch is pressed for longer than eight consecutive seconds, the BCM will de-energize the door lock relay.

The automatic door lock system can be enabled/disabled either by the customer or with the DRB III® scan tool. Refer to the DRB III® or the vehicle owners manual for enabling/disabling procedures.

**DESCRIPTION AND OPERATION (Continued)**

The BCM will automatically re-lock all doors if the above conditions are met and if any of the doors become ajar and then closes again.

The power latches are also equipped with a thermal protection system which prevents the latches from burning out.

**CENTRAL LOCKING SYSTEM****DESCRIPTION**

The central locking system is part of the Vehicle Theft Security System. This feature allows the doors to be locked/unlocked all at once with the turn of the key in the driver's or passenger's side door.

**OPERATION**

Using the key, turn the driver's or passenger door cylinder lock to the lock position, all doors will lock. This feature operates differently on each door. Turn key in the driver's door to the unlock position once will unlock driver's door only. Turning the key a second time to the unlock position within five seconds of the first time will unlock all doors. Turn key once in the passenger's door to the unlock position will unlock all doors.

The lock/unlock operation will arm/disarm the Vehicle Theft Security System and will also activate/cancel the illuminated entry feature.

**DOOR LOCK INHIBIT FEATURE****DESCRIPTION**

The door lock inhibit feature is designed to prevent the locking of keys in a vehicle. The driver's door cannot be locked unless the keys are removed from the ignition switch.

**OPERATION**

With the key in the ignition switch in the ON or OFF position and the driver's door open the BCM will ignore the command to lock the power door locks. Once the key is removed, or the driver's door is closed, the body control module will allow the power door locks to lock.

**DIAGNOSIS AND TESTING****AUTOMATIC DOOR LOCK SYSTEM**

For complete testing of the Automatic Door Lock System, refer to the proper Body Diagnostic Procedures Manual.

**DECK LID**

For vehicles equipped with electric deck lid release.

(1) Confirm deck lid release solenoid lead wire is connected to the deck lid relay. Check at the deck lid release solenoid for 10 volts or more while the relay is energized. Ensure that the visor lamps are operating they are on the same G38 circuit.

(2) Check for a proper ground through latch mounting screws and the Pin 14 of the BCM 20-way connector.

(3) Remove latch and examine plunger. Plunger should spring back when pressed.

(4) Ensure that solenoid plunger travel is adequate approximately 16 mm (5/8 inch).

**DOOR LOCK MOTOR/LATCH**

Ensure battery is in good condition before performing the circuit tests.

To determine which latch is faulty, check each individual door for electrical lock and unlock or disconnect the latch connectors one at a time, while operating the door lock switch. In the event that none of the latches work, the problem may be caused by a short or a bad switch. Disconnecting the defective latch will allow the others to work.

To test an individual door latch, disconnect the electrical connector from the latch. To lock the door, connect a 12 volt power source to the positive pin of the latch and a ground wire to the other pin (Fig. 1). To unlock the door reverse the wire connections at the latch pin terminals. If these results are NOT obtained, replace the door latch assembly.

**DOOR LOCK SWITCH**

Remove the door lock switch from its mounting location. Refer to Door Lock Switch Removal and Installation procedures. Using an ohmmeter, test door lock switch continuity. Refer to (Fig. 2) and move the switch to the Lock and Unlock positions. If the resistance values are not obtained, replace the switch.

**VOLTAGE**

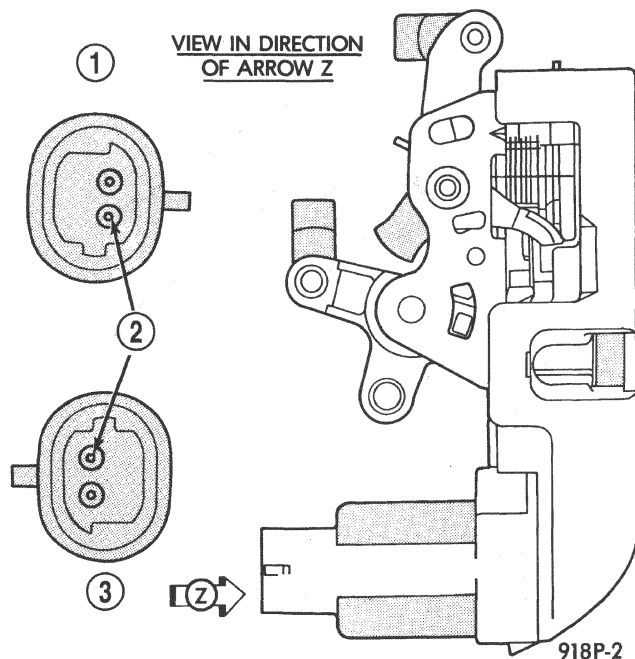
The following circuit test sequence determines whether or not voltage is continuous through the body harness to switch.

(1) Remove the driver door trim panel. Refer to Group 23, Body for proper procedures.

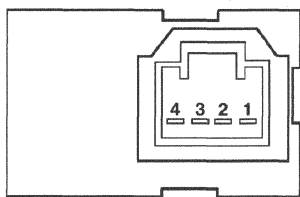
(2) Carefully separate multiple terminal block on wiring harness from switch body. Refer to Group 8W, Wiring Diagrams.

(3) Using a voltmeter, connect the ground lead to the Pin 3 of the door lock connector.

(a) Using the positive lead, check Pin 1 of the connector for battery voltage. If OK, go to Step b. If not OK, check fuse #5 in the Junction Block, and fuse #4 in the Power Distribution Center. If the fuse is OK, repair wire as necessary.

**DIAGNOSIS AND TESTING (Continued)****Fig. 1 Door motor/Latch Assembly**

- 1 - RH  
2 - + TO LOCK  
3 - LH



SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE VALUE
UNLOCK	1 AND 4	2700 $\Omega$ $\pm$ 10%
LOCK	1 AND 4	620 $\Omega$ $\pm$ 10%

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**Fig. 2 Door Lock Switch Continuity Test**

(b) Check Pin 2 of the connector for battery voltage. If OK, go to Switch Test. If not OK, check fuse

4 in the Junction Block, and fuse #16 in the Power Distribution Center. If the fuse is OK, repair wire as necessary.

**SERVICE PROCEDURES****AUTOMATIC DOOR LOCKS ENABLED/DISABLED**

To disable the Automatic Door Lock feature, do the following:

- (1) Close all doors.
- (2) Place the ignition switch in the OFF position for at least 20 seconds.
- (3) Turn the ignition switch to the RUN position and to the OFF position without cranking the engine four times. The Malfunction lamp will come on each time the ignition switch is in the RUN position.
- (4) Press the power door lock button to lock the doors.
- (5) A single chime should sound to indicate that the feature has been changed successfully. If no chime, repeat procedure.

To enable the automatic feature, repeat Step 1 through Step 4.



## REMOVAL AND INSTALLATION

### DOOR LOCK MOTOR

The Door Lock Motor is integral to the door latch. For service of the Door Lock Motor, the door latch must be removed. Refer to Group 23 body, for Door Latch Removal and Installation.

### DOOR LOCK SWITCH

#### REMOVAL

(1) Disconnect and isolate the battery negative remote cable.

(2) Start at the rear center of the bezel. Using your fingers or a trim stick, lift the bezel upwards and slightly inboard to disconnect the two rear clips (Fig. 3). Use care not to mar the door trim.

(3) With the rear of the bezel raised, pull the forward end up to release the third clip.

(4) Disconnect the power window switches and door lock switch wire connectors.

(5) Release the locking tabs and remove door lock switch.

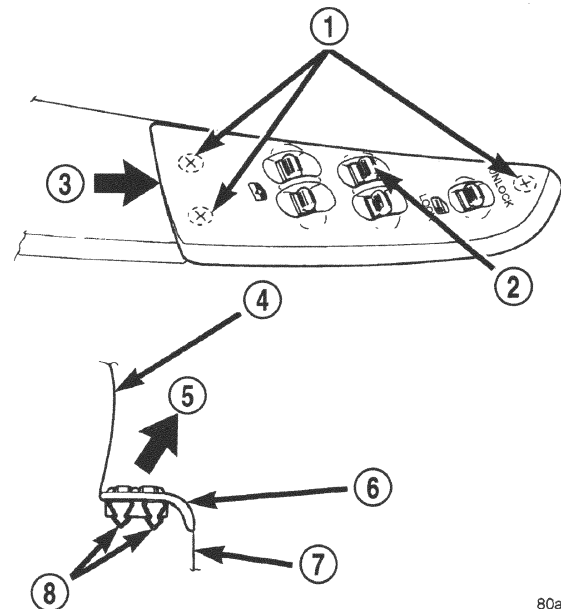
#### INSTALLATION

For installation, reverse the above procedures.

## ADJUSTMENTS

### DECK LID

Adjust the deck lid latch and striker so that deck lid latches with a moderate slam. Push deck lid release switch and the deck lid should release.



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**Fig. 3 Door and Switch Bezel**

- 1 - LOCATION OF BEZEL TO DOOR TRIM CLIPS UNDERNEATH
- 2 - AUTO
- 3 - LIFT POINT
- 4 - DOOR TRIM
- 5 - LIFT UPWARD & INBOARD IN THE DIRECTION OF ARROW
- 6 - SWITCH & BEZEL ASSEMBLY
- 7 - DOOR TRIM (ARMREST AREA)
- 8 - CLIPS

Should latch fail to lock or unlock replace latch assembly.

## REMOTE KEYLESS ENTRY

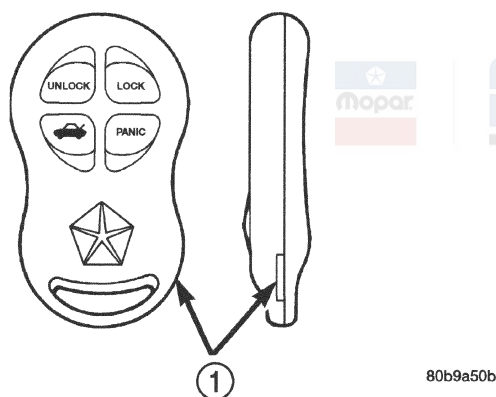
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## DESCRIPTION AND OPERATION

### REMOTE KEYLESS ENTRY SYSTEM

#### DESCRIPTION



**Fig. 1 Remote Keyless Entry (RKE) Transmitter**

1 - INSERT DIME

The Remote Keyless Entry (RKE) System allows locking/unlocking of vehicle door(s), unlatching of the deck lid, and a panic feature by remote control using a hand held radio frequency (RF) key fob transmitter.

The Body Control Module (BCM) may receive signals from up to four key fob transmitters. Each key fob transmitter has its own ID with a rolling code. The code is programmed and stored into BCM memory. The ID code of the key fob transmitter never changes. However the rolling code portion changes every time a button is pressed. If the key fob transmitter is replaced or an additional transmitter is added, the codes of all units may have to be reprogrammed into the BCM memory. If a BCM is replaced, the key fob transmitter codes must be pro-

grammed in the new BCM memory. If a programmed key fob transmitter button is pressed more than 250 times outside of the vehicle range, the rolling code will go out of synchronization. In this case the rolling code has to be synchronized again for complete operation. Refer to Synchronization of Rolling Code in this section.

#### OPERATION

The key fob transmitter has four buttons for operation. They are LOCK, UNLOCK, DECK LID RELEASE, and PANIC.

Depressing the button:

- UNLOCK button will unlock the driver's door and enable illuminated entry, if equipped. Pushing and releasing the button once will unlock the driver's door. Pushing and releasing the button two times, within five seconds interval, will unlock all doors.
- LOCK button, the horn will sound a short CHIRP to notify that the all door lock signal was received and set. The illuminated entry operation will be cancelled and all interior lamps will immediately turn OFF.
- DECK LID RELEASE will unlatch the deck lid. Opening the deck lid will not disarm the Vehicle Theft Security System (VTSS), but will allow the customer to access the trunk without the VTSS going off.
- PANIC button will start the panic mode when the button is pressed for more than one second. The driver door will unlock. The horn will sound and the headlamps flash approximately once a second. The interior lamps will come ON. The PANIC mode can be cancelled by pressing the unlock button, or will time out in approximately three minutes.

**NOTE: PANIC mode is cancelled when the vehicle speed reaches 15 mph.**

## DESCRIPTION AND OPERATION (Continued)

The BCM is capable of retaining Vehicle Access Code (VAC) even when power is removed.

Each Remote Keyless Entry Module must have at least one and no more than four key fob transmitters.

### DECK LID RELEASE RELAY

#### DESCRIPTION

The Deck Lid Release circuit works in conjunction with the BCM to prevent unwanted operation after the Vehicle Theft Security System is set. The VTSS portion of the BCM will also disable the Universal Transmitter (garage door opener).

#### OPERATION

The relay is energized from either the deck lid release switch or from the BCM from a signal from the Remote RKE fob transmitter.

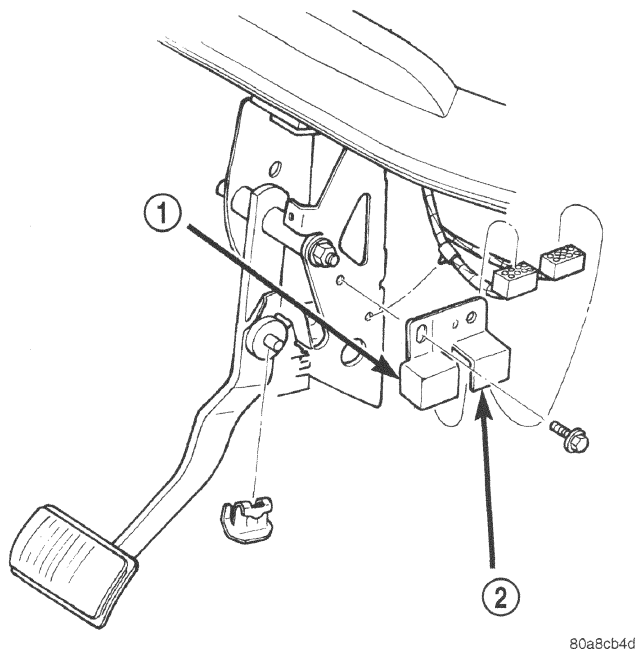
## DIAGNOSIS AND TESTING

### DECK LID RELEASE RELAY TEST

#### RELAY TEST

The deck lid release relay is located on the right side of the brake pedal mounting bracket (Fig. 2).

Remove the starter relay from mounting bracket to perform the following tests:



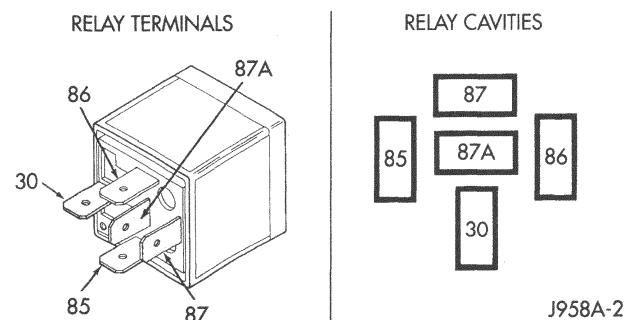
**Fig. 2 Deck Lid Release Relay Location**

- 1 - COURTESY ILLUMINATION LAMP RELAY
- 2 - DECK LID RELEASE RELAY

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be  $75 \pm 5$  ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery B+ lead to terminals 86 and a ground lead to terminal 85 to energize the relay. The relay should click. Also test for continuity between terminals 30 and 87, and no continuity between terminals 87A and 30. If OK, refer to Relay Circuit Test procedure. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

#### Deck Lid Release Relay

#### RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery common voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open circuit to the circuit breaker as required.

(2) The relay normally open terminal (87) is connected to the common feed (movable contact) terminal (30) in the energized position. This terminal when energized supplies battery voltage to the deck lid release solenoid. If OK, go to Step 3. If not OK, repair the open circuit to the deck lid release solenoid as required.

(3) The coil battery (+) terminal (86) is connected to the electromagnet in the relay. It has battery (+) at all times. Check for battery voltage at cavity (86) of the relay connector. If OK, go to Step 4. If not OK, check for an open circuit to the deck lid release relay and repair as necessary.



## DIAGNOSIS AND TESTING (Continued)

(4) The relay coil ground (-) terminal (85) is connected to the Body Control Module Q33 circuit and deck lid release switch. This terminal will receive a ground (-) through the BCM, or the deck lid release switch, when the key fob transmitter button, or the deck lid release switch is depressed. If not OK, check for an open circuit to the BCM and repair as necessary.

(5) When the Vehicle Theft Security System is armed the BCM opens the ground circuit to the deck lid release switch.

## DIAGNOSTIC CONDITIONS

When trouble shooting problems with the Remote Keyless Entry System, always verify that the power door lock/unlock switches are functional. If the doors do not lock/unlock with the power switches, the following modules should be analyzed: Lock/Unlock Switches, Body Control Module, and the door lock/unlock latches. Refer to Group 8W, Wiring Diagrams.

### FUSE TEST

If the following modules do not work:

- Remote Keyless Entry System
- Body Control Module
- Door lock switches

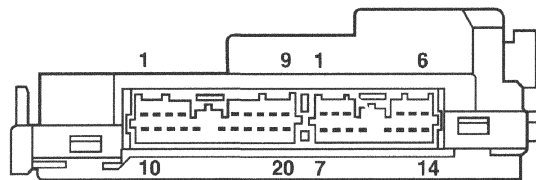
A blown fuse is the probable cause. The Body Control Module (BCM) battery feed fuse are located in the Power Distribution Center (PDC). Check fuses 4, 15 and 18 in the PDC and fuses 4, 5 and 9 in the Junction Block.

### Key fob transmitter will not lock or unlock doors.

- (1) Check that the BCM has power and ground.
- (2) If the RKE still doesn't function. Check the key fob transmitter batteries for 3 Volts each. If less than 3 Volts, replace the battery.
- (3) If the system still does not work, replace the key fob transmitter. Refer to Programing Remote Keyless Entry key fob Transmitter.

### All doors will not unlock with the key fob transmitter.

- (1) Using a voltmeter, check Pin 4 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Press the unlock button once.
- (2) If no voltage pulse, replace RKE module. If voltage is measured, repair the harness between the BCM and the driver door latch.
- (3) Check Pin 1 of the BCM 20 Pin connector for a quick voltage pulse when the unlock button is pressed.
- (4) If no voltage pulse is measured at Pin 1, replace the BCM. Repair the harness between terminal and lock latch.



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**Fig. 3 BCM 20-Way Connector**

### Driver door will NOT unlock with the key fob transmitter, but passenger door will unlock.

(1) Using a voltmeter, check Pin 4 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Depress the unlock button. The voltmeter should read battery voltage for approximately 1 second.

(2) If no voltage pulse is measured, replace the BCM. If voltage is measured repair harness from BCM to the driver door latch.

### Driver door will unlock with the key fob transmitter, but passenger door will not lock.

(1) Using a voltmeter, check Pin 1 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Press the unlock button.

(2) If no voltage pulse is measured, replace the BCM. If voltage is measured, repair the harness to the door latch.

### Doors do not lock with the key fob transmitter.

(1) Using a voltmeter, check Pins 10 and 11 of the BCM 20 Pin connector for a voltage pulse (Fig. 3). Press the lock button on the transmitter. Wait for quick voltage pulse. It may be necessary to press the key fob transmitter several times. The voltage pulse only appears for milliseconds.

(2) If no voltage pulse is measured, replace BCM. If a voltage is measured, repair the Junction Block as necessary.

### Doors will lock with the key fob transmitter but there is no horn CHIRP.

- (1) Press horn button, listen horn sound.
- (2) If the horn does not CHIRP, check if horn is disabled with the scan tool (DRB). Then check the horn relay and the horn(s). Repair as necessary.
- (3) Using a voltmeter, check horn relay for voltage pulse (Fig. 3). Press the lock button on the key fob transmitter.
- (4) If no voltage pulse measured, replace the BCM. If voltage is measured, repair harness to the horn relay.

**DIAGNOSIS AND TESTING (Continued)****Unable to program BCM with a new key fob transmitter, door locks will not cycle.**

Refer to the proper Body Diagnostic Procedure Manual.

**Unable to program BCM with a new key fob transmitter, door locks cycle. The locks will not cycle when the transmitter button is depressed.**

Refer to the proper Body Diagnostic Procedure Manual.

**SERVICE PROCEDURES****HORN CHIRP ENABLE/DISABLE**

The DRB III® scan tool must be used to enable/disable the Horn Chirp. Refer to the DRB III® scan tool for the procedure.

**PROGRAMMING RKE MODULE**

The DRB III® and the transmitter must be used to program the Remote Keyless Entry Module. Refer to the DRB III® for the procedure.

**SYNCHRONIZATION OF ROLLING CODE**

The key fob transmitter code will go out of synchronization if any button is pressed more than 250 times outside the range of the receiver which is inside of the BCM. In other words the transmitter will not work. To synchronize the code of a particular key fob transmitter with the receiver, press and hold the lock button then the deck lid button simultaneously for at least five seconds. Then wait until the doors unlock indicating that the code has been synchronized. This may take as long as six minutes. This is for a key fob transmitter that has been previously programmed to this vehicle only.

**TRANSMITTER BATTERY**

The transmitter has two 3 volt batteries, which can be removed and replaced without special tools. The battery is available at local retail stores. Recommended batteries are Toshiba CR2016 or equivalent. Battery life is about one to two years.

**REMOVAL AND INSTALLATION****BODY CONTROL MODULE (BCM)**

Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.

**DECK LID RELEASE RELAY****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable.

(2) The relay is located above the brake pedal to the right side (Fig. 2).

(3) Grasp the relay and pull downward to disconnect the relay.

**INSTALLATION**

Align the relay pins with the connector terminals and push the relay in to place.

**JUNCTION BLOCK (JB)**

Refer to Group 8O, Power Distribution Systems for Removal and Installation.

**SPECIFICATIONS****TRANSMITTER CONTROL RANGE**

Operation range is within 7 meters (23 ft.) of the BCM.

# VEHICLE THEFT/SECURITY SYSTEMS

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## DESCRIPTION AND OPERATION

### VEHICLE THEFT SECURITY SYSTEM (VTSS)

#### DESCRIPTION

The Vehicle Theft Security System (VTSS) is available factory-installed optional equipment for this model. It is a passive system and is designed to protect against whole vehicle theft. The system monitors vehicle doors and deck lid key cylinder for unauthorized operation.

If the vehicle is equipped with VTSS, it will also include the Sentry Key Immobilizer System (SKIS) factory-installed option.

The VTSS activates:

- Sounding of the horn
- Flashing of the interior lamps
- Flashing of the headlamps
- An engine kill feature (SKIS module controlled)

#### OPERATION

Refer to the vehicle owner's manual for more information on the use and operation of the Sentry Key Immobilizer System (SKIS). Refer to Group 8W, Wiring Diagrams for complete circuit descriptions and diagrams.

Passive arming occurs upon normal vehicle exit: Open door, lock with power locks, close door. The Vehicle Theft security LED lamp in the instrument

cluster will flash quickly for 15 seconds, indicating that arming is in progress. If no monitored switches are activated during this period, the system will arm. After 15 seconds the LED lamp will continue to flash but at a slower rate. This indicates that the system is armed. If the deck lid key cylinder switch is not sensed by the system, the LED lamp will remain lit during the arming process, although the system will still arm.

The system is to be considered as an active armed system when using:

- The Remote Keyless Entry
- The Central Lock Feature.

If the LED lamp does not illuminate at all upon door closing it indicates that the system is not arming or the LED lamp is not operation. Refer to the System Self-Tests.

Passive disarming occurs upon normal vehicle entry by unlocking either door with the ignition key/remote transmitter. This disarming will also halt the alarm once it has been activated.

A tamper alert exists to notify the driver that the alarm had been activated. If the alarm has since timed-out for at least 3 minutes but not more than 18 minutes the tamper alert will sound. If the trunk lid has been activated the tamper alert will sound till the VTSS is disarmed. The tamper alert consists of 3 horn pulses when the vehicle is disarmed.



**DESCRIPTION AND OPERATION (Continued)**

The alarm system will not arm if the doors are locked manually by pushing the lock knobs. This will manually override the system.

The VTSS also deactivates the Universal Transmitter (garage door opener) when the vehicle is armed. The deck lid can only be opened using the key or inside release handle when the VTSS is armed. When the vehicle is disarmed, the systems are restored to normal operation.

**SENTRY KEY IMMOBILIZER SYSTEM (SKIS)****DESCRIPTION**

The Sentry Key Immobilizer System (SKIS) is designed to provide passive protection against unauthorized vehicle use by preventing the engine from operating without a valid sentry key transponder.

The components of this system are:

- Sentry Key Immobilizer Module (SKIM)
- Sentry Key Transponder
- Vehicle Theft/Security System (VTSS) indicator LED

- Powertrain Control Module (PCM)

The SKIM is installed on the steering column near the ignition lock cylinder. The transponder is located under the molded rubber cap on the head of the ignition key. The VTSS indicator LED is located in the instrument cluster.

The SKIS includes three valid Sentry Key transponders from the factory, one being a valet key. This is so the customer can self program new keys if one is lost. If the customer wishes, additional non-coded blank Sentry Keys are available. These blank keys can be cut to match a valid ignition key, but the engine will not start unless the key transponder is also programmed to the vehicle. The SKIS will recognize no more than eight valid Sentry Key transponders at any one time.

**OPERATION**

The SKIS performs a self-test each time the ignition switch is turned to the ON position, and will store Diagnostic Trouble Codes (DTCs) if a system malfunction is detected. The SKIS can be diagnosed, and any stored DTC can be retrieved using a DRB III® scan tool as described in the proper Body Diagnostic Procedures Manual.

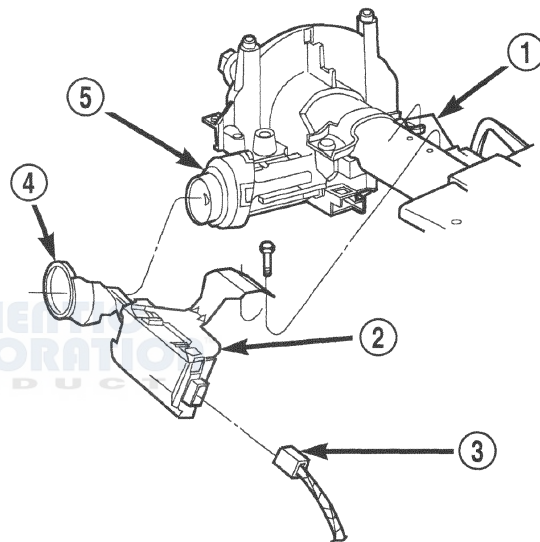
**CENTRAL LOCK/UNLOCK SYSTEM****DESCRIPTION**

The central lock/unlock system uses the Vehicle Theft Security System (VTSS) door key cylinder switches to lock and unlock all doors using the key.

**OPERATION**

Turning the key to the lock position in the driver's or passenger's door will lock all doors. Turning the key in the driver's door to the unlock position once will unlock driver's door only. Turning the key a second time within five seconds of the first time will unlock all doors. Turning the key in the passenger's door to the unlock position will unlock all doors.

Using the door key cylinder or the RKE transmitter lock/unlock operation will arm/disarm the Vehicle Theft Security System (VTSS).

**SENTRY KEY IMMOBILIZER MODULE (SKIM)****DESCRIPTION**

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**Fig. 1 Sentry Key Immobilizer Module (SKIM)**

- 1 - STEERING COLUMN
- 2 - SENTRY KEY IMMOBILIZER MODULE
- 3 - SKIM CONNECTOR
- 4 - ANTENNA
- 5 - IGNITION KEY CYLINDER

The Sentry Key Immobilizer Module (SKIM) contains a Radio Frequency (RF) transceiver and a central processing unit, which includes the Sentry Key Immobilizer System (SKIS) program logic. The SKIS programming enables the SKIM to program and retain in memory the codes of at least two, but no more than eight electronically coded Sentry Key transponders. The SKIS programming also enables the SKIM to communicate over the Chrysler Collision Detection (CCD) data bus network with the Powertrain Control Module (PCM), the instrument cluster and/or the DRB III® scan tool.

## DESCRIPTION AND OPERATION (Continued)

### OPERATION

The SKIM transmits and receives RF signals through a tuned antenna enclosed within a molded plastic ring formation that is integral to the SKIM housing. When the SKIM is properly installed on the steering column, the antenna ring is oriented around the circumference of the ignition lock cylinder housing. This antenna ring must be located within eight millimeters (0.31 inches) of the Sentry Key in order to ensure proper RF communication between the SKIM and the Sentry Key transponder.

For added system security, each SKIM is programmed with a unique "Secret Key" code and a security code. The SKIM keeps the "Secret Key" code in memory and sends the code over the CCD data bus to the PCM, which also keeps this code in its memory. The SKIM also sends the "Secret Key" code to each of the programmed Smart Key transponders. The security code is used by the assembly plant to access the SKIS for initialization, or by the dealer technician to access the system for service. The SKIM also stores in its memory the Vehicle Identification Number (VIN), which it learns through a CCD data bus message from the PCM during initialization.

The SKIM and the PCM both use software that includes a rolling code algorithm strategy, which helps to reduce the possibility of unauthorized SKIS disarming. The rolling code algorithm ensures security by preventing an override of the SKIS through the unauthorized substitution of the SKIM or the PCM. However, the use of this strategy also means that replacement of either the SKIM or the PCM units will require a system initialization procedure to restore system operation.

When the ignition switch is turned to the ON or START positions, the SKIM transmits an RF signal to excite the Sentry Key transponder. The SKIM then listens for a return RF signal from the transponder of the Sentry Key that is inserted in the ignition lock cylinder. If the SKIM receives an RF signal with valid "Secret Key" and transponder identification codes, the SKIM then sends a "valid key" message to the PCM over the CCD data bus. If the SKIM receives an invalid RF signal or no response, it sends "invalid key" messages to the PCM. The PCM will enable or disable engine operation based upon the status of the SKIM messages.

The SKIM also sends messages to the instrument cluster over the CCD data bus network to control the VTSS indicator LED. The SKIM sends messages to the instrument cluster to turn the LED on for about three seconds when the ignition switch is turned to the ON position as a bulb test. After completion of the bulb test, the SKIM sends bus messages to keep the LED off for a duration of about one second. Then the SKIM sends messages to turn the LED on or off

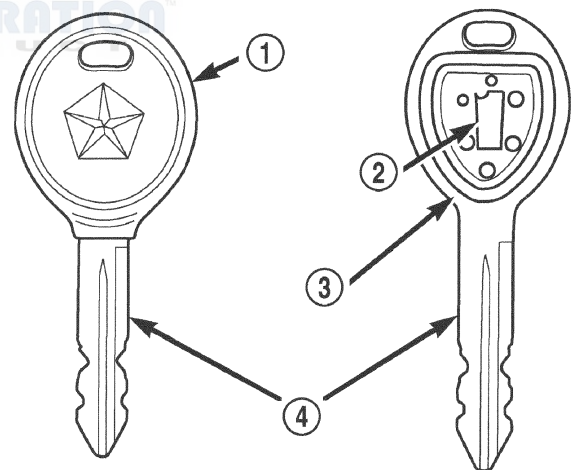
based upon the results of the SKIS self-tests. If the VTSS indicator LED comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative.

If the SKIM detects an invalid key when the ignition switch is turned to the ON position, it sends messages to the instrument cluster to flash the VTSS indicator LED. The SKIM can also send messages to the instrument cluster to flash the LED and to generate a single audible chime tone. These functions serve as an indication to the customer that the SKIS has been placed in its "Customer Learn" programming mode. See Sentry Key Immobilizer System Transponder Programming in this group for more information on the "Customer Learn" programming mode.

For diagnosis or initialization of the SKIM and the PCM, a DRB III® scan tool and the proper Body Diagnostic Procedures Manual are required. The SKIM cannot be repaired, and if faulty or damaged, the unit must be replaced.

## SENTRY KEY IMMOBILIZER TRANSPONDER

### DESCRIPTION



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**Fig. 2 Sentry Key Immobilizer Transponder**

- 1 - MOLDED CAP
- 2 - TRANSPONDER
- 3 - MOLDED CAP REMOVED
- 4 - SENTRY KEY

The Sentry Key Immobilizer System (SKIS) uses a transponder that is integral to each of three ignition key that are supplied with the vehicle when it is shipped from the factory. The transponder chip is insulated within a nylon mount inserted in the head of the key, and invisible beneath a molded rubber cap.



**DESCRIPTION AND OPERATION (Continued)**

Each Sentry Key transponder has a unique transponder identification code programmed into it by the manufacturer. The Sentry Key Immobilizer Module (SKIM) has a unique "Secret Key" code programmed into it by the manufacturer. When a Sentry Key transponder is programmed into the memory of the SKIM, the SKIM learns the transponder identification code from the transponder, and the transponder learns the "Secret Key" code from the SKIM. Each of these codes is stored within the transponder and in the nonvolatile memory of the SKIM. Therefore, blank keys for the SKIS must be programmed by and into the SKIM, in addition to being cut to match the mechanical coding of the ignition lock cylinder. See Sentry Key Immobilizer System Transponder Programming in this group for more information.

The Sentry Key transponder cannot be repaired and, if faulty or damaged, it must be replaced.

**OPERATION**

The Sentry Key transponder is within the range of the SKIM transceiver antenna ring when it is inserted in the ignition lock cylinder. When the ignition switch is turned to the START or RUN positions, the SKIM transceiver issues a Radio Frequency (RF) signal that excites the transponder chip. The transponder chip responds by issuing an RF signal containing its transponder identification code and the "Secret Key" code. The SKIM transceiver compares the transponder codes with the codes stored in its memory to determine whether a valid key is in the ignition lock cylinder.

**SENTRY KEY IMMOBILIZER SYSTEM INDICATOR LAMP****DESCRIPTION**

The Sentry Key Immobilizer System (SKIS) uses the Vehicle Theft Security System (VTSS) indicator LED to give an indication when the SKIS is faulty or when the vehicle has been immobilized due to the use of an invalid ignition key. The LED is controlled by the instrument cluster circuitry based upon messages received from the Sentry Key Immobilizer Module (SKIM) through the Body Control Module (BCM) on the Chrysler Collision Detection (CCD) data bus.

**OPERATION**

The SKIM sends messages to the instrument cluster, via the BCM, to turn the LED on for about three seconds when the ignition switch is turned to the ON position as a bulb test. After completion of the bulb test, the SKIM sends bus messages to keep the LED off for a duration of about one second. Then the SKIM sends messages to the instrument cluster cir-

cuitry to turn the LED on or off based upon the results of the SKIS self-tests. If the VTSS indicator LED comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative. If the SKIM detects an invalid key when the ignition switch is turned to the ON position, it sends messages to the instrument cluster to flash the VTSS indicator LED.

The SKIM can also send messages to the instrument cluster to flash the LED and to generate a single audible chime tone. These functions serve as an indication to the customer that the SKIS has been placed in its "Customer Learn" programming mode. See Sentry Key Immobilizer System Transponder Programming in this group for more information on the "Customer Learn" programming mode.

The VTSS indicator LED uses a replaceable Light Emitting Diode (LED) on the instrument cluster electronic circuit board. Refer to Group 8E - Instrument Panel Systems for Diagnosis and Testing and service of a faulty VTSS indicator LED. If the VTSS indicator LED comes on and stays on after the bulb test function, diagnosis of the SKIS should be performed with a DRB III® scan tool and the proper Body Diagnostic Procedures Manual.

**TRIGGERING THE VTSS****DESCRIPTION**

Any of the following actions will trigger the system:

- (1) Opening any door.
- (2) Removing the deck lid lock cylinder.
- (3) Turning the ignition to the ON position.

**OPERATION**

Using the power door switch, ignition key or the Remote Keyless Entry (RKE) transmitter will arm the system.

**CAUTION:** The VTSS indicator LED will trigger and engine will continue to run if the vehicle is equipped with SKIS and the proper key is used to start the vehicle. This condition will occur if the VTSS has been triggered.

**NOTE:** The ignition switch can be turned to the accessory position without triggering alarm system.

**DIAGNOSIS AND TESTING****HEADLAMP RELAY**

For test of headlamp relay use a known good relay. Refer to Group 8W. Wiring Diagrams for circuits.



**DIAGNOSIS AND TESTING (Continued)****HORN RELAY**

Refer to Group 8G, Horns for test procedures.

**SENTRY KEY IMMOBILIZER SYSTEM**

**WARNING: ON VEHICLES EQUIPPED WITH AIR-BAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIR-BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**

**NOTE:** The following tests may not prove conclusive in the diagnosis of this system. The most reliable, efficient, and accurate means to diagnose the Sentry Key Immobilizer System (SKIS) involves the use of a DRB III® scan tool. Refer to the proper Body Diagnostic Procedures Manual.

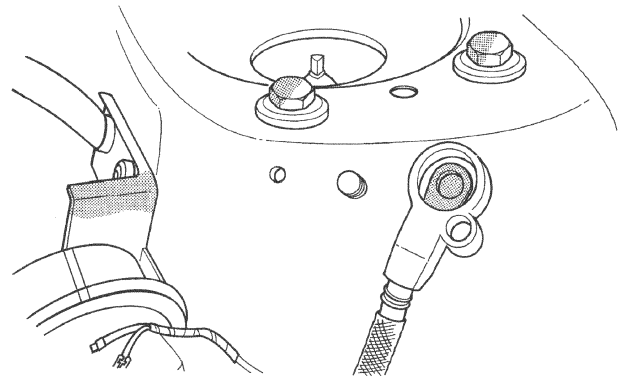
The Sentry Key Immobilizer System (SKIS) and the Chrysler Collision Detection (CCD) data bus network should be diagnosed using a DRB III® scan tool. The DRB III® will allow confirmation that the CCD data bus is functional, that the Sentry Key Immobilizer Module (SKIM) is placing the proper messages on the CCD data bus, and that the Powertrain Control Module (PCM) and the instrument cluster are receiving the CCD data bus messages. Refer to the proper Body Diagnostic Procedures Manual. Refer to Group 8W, Wiring Diagrams for complete circuit descriptions and diagrams.

(1) Check the fuses in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Disconnect and isolate the battery negative remote cable (Fig. 3). Unplug the wire harness connector at the SKIM. Check for continuity between the ground circuit cavity of the SKIM wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit to ground as required.

(3) Connect the battery negative remote cable. Check for battery voltage at the fused B(+) circuit cavity of the SKIM wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit to the fuse in the junction block as required.

(4) Turn the ignition switch to the ON position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the SKIM wire harness connector. If OK, use a DRB III® scan tool and the proper Body Diagnostic Procedures Manual to complete the diagnosis of the SKIS. If not OK,



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**Fig. 3 Battery Negative Remote Cable**

repair the open circuit to the fuse in the junction block as required.

**VEHICLE THEFT / SECURITY SYSTEM (VTSS) SELF - TESTS**

A diagnostics test mode is available in the system to verify operation of all monitored switches or circuits. To enter diagnostics mode, use a DRB III® scan tool and the proper Body Diagnostic Procedure Manual.

The horn will pulse twice to indicate that the deck lid security switch is present. Placing the key in the ignition will allow the warning lamp, headlamps and interior lamps to be checked for proper flashing operation. If any door is open the interior lamps will not flash. Remove the ignition key from the ignition switch in order to check for door key cylinder switch operation. At the completion of each of the following operations, a horn pulse will occur to indicate proper operation. Each action must be separated by a minimum of one second or horn pulse will not occur.

- Activate the power door locks in both the lock and unlock positions.
- Open then close each door one at a time.
- Rotate the ignition key in each of the door lock cylinders to the lock and unlock positions.
- Cycle the ignition switch key to the ON position as the last step. A single horn pulse will indicate proper operation of the ignition switch. This will also take the system out of the stand alone diagnostic mode.

The self diagnostic mode may also be exited by using the DRB III® scan tool.

Activating the Remote Keyless Entry System (RKE) to exercise any of the above inputs will also cause the horn to pulse. When the RKE lock button is pressed, the RKE module itself will also pulse the horn. This is part of the RKE normal operation.

## SERVICE PROCEDURES

### SENTRY KEY IMMOBILIZER SYSTEM INITIALIZATION

The Sentry Key Immobilizer System (SKIS) initialization should be performed following a SKIM module replacement. It can be summarized by the following:

(1) Obtain the vehicle's unique PIN number assigned to its original SKIM module from the vehicle owner, the vehicle's invoice or from Chrysler's Customer Center.

(2) With the DRB III® scan tool, select "Theft Alarm," "SKIM," Miscellaneous." Select "SKIM Module Replaced" function and the DRB III® will prompt you through the following steps.

(3) Enter secured access mode using the unique four digit PIN number.

(4) The DRB III® will read the vehicle's VIN number, ask the user to verify that it is correct, and program it into the SKIM's memory.

(5) Program the country code into the SKIM's memory (U. S.).

(6) Transfer the vehicle's unique Secret Key data from the PCM. This process will require the SKIM module to be in **secured access mode**. The PIN number must be entered into the DRB III® before the SKIM will enter **secured access mode**. Once **secured access mode** is active, the SKIM will remain in that mode for 60 seconds.

(7) Program all customer keys into the SKIM's memory. This required that the SKIM be in **secured access mode**. The SKIM module will immediately exit **secured access mode** after each key is programmed.

**NOTE: SECURED ACCESS MODE is not required to query the programmed status of the key.**

**NOTE: If a PCM is replaced, the unique "Secret Key" data must be transferred from the SKIM module to the PCM. This procedure requires the SKIM to be placed in SECURED ACCESS MODE using the four digit PIN code.**

### SENTRY KEY IMMOBILIZER SYSTEM TRANSPONDER PROGRAMMING

Three programmed Sentry Key transponders are included with the Sentry Key Immobilizer System (SKIS) when it is shipped from the factory. The Sentry Key Immobilizer Module (SKIM) can be programmed to recognize up to five additional transponders, for a total of eight Sentry Keys. The following "Customer Learn" programming procedure

for the programming of additional transponders requires access to at least two of the valid Sentry Keys. If two valid Sentry Keys are not available, Sentry Key programming will require the use of a DRB III® scan tool.

### CUSTOMER LEARN PROGRAMMING

(1) Obtain the additional Sentry Key transponder blank(s) that are to be programmed for the vehicle. Cut the additional Sentry Key transponder blanks to match the ignition lock cylinder mechanical key codes.

(2) Insert one of the two valid Sentry Key transponders into the ignition switch and turn the ignition switch to the ON position.

(3) After the ignition switch has been in the ON position for about three seconds, but no more than fifteen seconds, cycle the ignition switch back to the OFF position. Replace the first valid Sentry Key in the ignition lock cylinder with the second valid Sentry Key and turn the ignition switch back to the ON position. Both operations must be performed within 15 seconds.

(4) About ten seconds after the completion of Step 3, the VTSS indicator LED will start to flash and a single audible chime tone will sound to indicate that the system has entered the "Customer Learn" programming mode.

(5) Within about fifty seconds of entering the "Customer Learn" programming mode, turn the ignition switch to the OFF position, replace the valid Sentry Key with a blank Sentry Key transponder, and turn the ignition switch back to the ON position.

(6) About ten seconds after the completion of Step 5, a single audible chime tone will sound and the VTSS indicator LED will stop flashing and stay on solid for about three seconds to indicate that the blank Sentry Key transponder has been successfully programmed. The SKIS will immediately return to normal system operation following exit from the "Customer Learn" programming mode.

(7) Go back to Step 2 and repeat this process for each additional Sentry Key transponder blank to be programmed.

If any of the above steps is not completed in the proper sequence, or within the allotted time, the SKIS will automatically exit the "Customer Learn" programming mode. The SKIS will also automatically exit the "Customer Learn" programming mode if it sees a non-blank Sentry Key transponder when it should see a blank, if it has already programmed eight valid Sentry Keys, or if the ignition switch is turned to the OFF position for more than about fifty seconds.



## SERVICE PROCEDURES (Continued)

### PROGRAMMING BLANK SENTRY KEY TRANSPONDERS WITH A DRB III® SCAN TOOL

When programming a blank Sentry Key transponder, the key blank must first be cut to match the ignition lock cylinder. It will also be necessary to enter the vehicle's four digit PIN code into the DRB III® scan tool to enter the Sentry Key Immobilizer Module's (SKIM's) secured access mode.

**NOTE:** Once a Sentry Key is programmed to a particular vehicle, it cannot be transferred to another vehicle.

Insert the blank key into the ignition and turn it to the RUN position. Using the DRB III® scan tool, select "Theft Alarm," then "SKIM," then "Miscellaneous." Select "Program New Key." Enter the four digit PIN code using the DRB III®. When programming is completed, the SKIM will exit secured access mode and display the status of the key. One of five different status messages may be displayed as follows:

- "Programming Successful" is displayed if SKIM Sentry Key programming succeeds.
- "Learned Key in Ignition" is displayed if the key in the ignition has already been programmed into that vehicle's SKIM.
- "8 Keys Already Learned (At The Maximum) Programming Not Done" is displayed if eight keys have already been programmed into the SKIM. In this case, if a new key needs to be added due to a lost or defective key, the "Erase All Keys" function (requires entering secured access mode) has to be performed. Then the customer is seven keys plus the new key **MUST** be reprogrammed into the SKIM.
- "Programming Not Attempted" is displayed after an "Erase All Keys" function is executed.
- "Programming Key Failed" is displayed if further diagnosis is required.
- To learn additional keys, turn the ignition OFF, remove the learned key, and insert the next new blank key. Turn ignition to the RUN position and re-enter the secured access mode function and repeat the "Program New Key" procedure outlined above.

## REMOVAL AND INSTALLATION

### BODY CONTROL MODULE (BCM)

For service of the Body Control Module (BCM), Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.

**NOTE:** If BCM is replaced, the VTSS must be enabled in the new BCM via the DRB III®, in order to start the vehicle.

### JUNCTION BLOCK (JB)

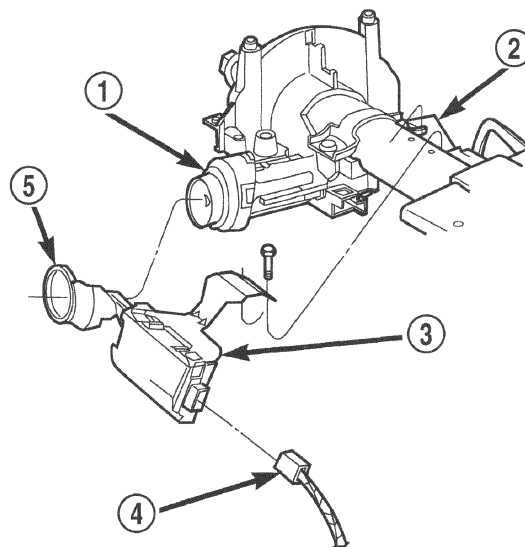
Refer to Group 8O, Power Distribution Systems for Removal and Installation.

### SENTRY KEY IMMOBILIZER MODULE (SKIM)

**WARNING: ON VEHICLES EQUIPPED WITH AIR-BAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIR-BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**

### REMOVAL

- (1) Disconnect and isolate the battery negative remote cable (Fig. 3).
- (2) Remove knee bolster. Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.
- (3) Remove the steering column upper and lower shrouds. Refer to Group 19, Steering for Removal and Installation.
- (4) Disengage the steering column wire harness from the Sentry Key Immobilizer Module (SKIM).



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**Fig. 4 Sentry Key Immobilizer Module (SKIM)**  
**Remove / Install**

- 1 - IGNITION KEY CYLINDER
- 2 - STEERING COLUMN
- 3 - SENTRY KEY IMMOBILIZER MODULE (SKIM)
- 4 - SKIM CONNECTOR
- 5 - SKIM ANTENNA



**REMOVAL AND INSTALLATION (Continued)**

(5) Remove the two screws securing the SKIM module to the top of the steering column.

(6) Rotate the SKIM and its mounting bracket upwards and then to the side away from the steering column to slide the SKIM antenna ring from around the ignition switch lock cylinder housing.

(7) Remove the SKIM from the vehicle.

**INSTALLATION**

(1) For installation, reverse the above procedures.

(2) If the SKIM is replaced with a new unit, a DRB III® scan tool MUST be used to initialize the new SKIM and to program at least two Sentry Key transponders. Refer to Sentry Key Immobilizer Module Initialization in this section.

**VEHICLE THEFT/SECURITY SYSTEM (VTSS)  
DECK LID SECURITY SWITCH**

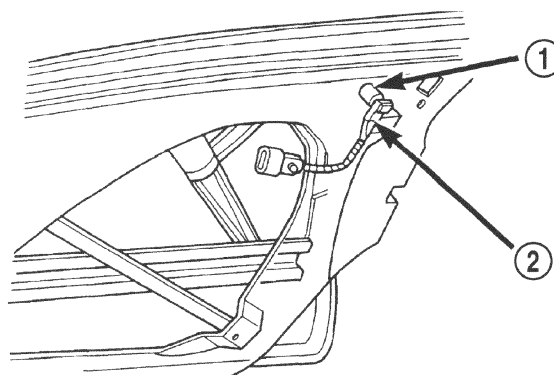
The Vehicle Theft Security System (VTSS) Deck Lid Security Switch is part of the deck lid latch. If replacement of the deck lid security switch is required, the deck lid latch will need to be replaced. Refer to Group 23, Body for deck lid latch Removal and Installation.

**VEHICLE THEFT/SECURITY SYSTEM (VTSS)  
DOOR CYLINDER LOCK SWITCH**
**REMOVAL**

(1) Disconnect and isolate the battery negative remote cable.

(2) Refer to Group 23, Body for door trim and water shield Removal and Installation.

(3) Remove illuminated entry switch wiring clip and disconnect connector (Fig. 5).



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**Fig. 5 VTSS Door Cylinder Lock Switch Location**

1 - KEY CYLINDER

2 - DOOR KEY CYLINDER SWITCH

(4) Remove disarming switch from door handle.

**INSTALLATION**

For installation reverse above procedures.

# POWER SEAT SYSTEMS

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## DESCRIPTION AND OPERATION

### POWER SEAT SYSTEMS

#### DESCRIPTION

Power seats can be adjusted in 6 different directions:

- Up or down
- Forward or back
- Tilt forward or rearward

#### OPERATION

Two single armature permanent magnet reversible motors are coupled through cables to worm gear box assemblies. They are located in the seat tracks and upper supports. The two single gear motor assemblies attach to the seat tracks and provide the various seat movements.

The electrical circuit is protected by a 20 amp circuit breaker located in the junction block.

## DIAGNOSIS AND TESTING

### DIAGNOSTIC PROCEDURE

Before any testing is attempted the battery should be carefully charged and all connections and terminals cleaned and tightened to insure proper continuity and grounds.

With dome lamp on, apply switch in direction of failure. If dome lamp dims the seat motor is trying to work indicating mechanical jamming. If dome lamp does not dim, then proceed with the following electrical tests.

### CIRCUIT BREAKER

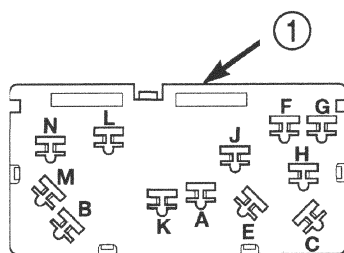
Find the correct circuit breaker in the junction block. Pull out slightly but be sure that circuit breaker terminals still contact terminals in junction block. Connect ground wire of voltmeter to a good ground. With probe of voltmeter positive wire, check both terminals of circuit breaker for battery voltage. If only one terminal checks at battery voltage, circuit breaker is defective and must be replaced. If neither terminal shows battery voltage, check for open or shorted circuit to circuit breaker.

### SEAT MOTOR

- (1) Remove power seat switch from seat.
- (2) Disconnect wire harness connector.
- (3) Check Pin A for battery voltage and Pin B for ground.
- (4) To test the seat motors, refer to the (Fig. 1), and verify proper seat responses. Using two jumper wires, connect one to a battery supply and the second to a ground. Connect the other ends to the seat wire harness connector as described in the Seat Connector table (Fig. 1).

### SEAT CONNECTOR

CONNECT JUMPER		SEAT ACTION
BATTERY	GROUND	DRIVER SIDE
PIN J	PIN E	FRONT RISER UP
PIN E	PIN J	FRONT RISER DOWN
PIN K	PIN L	FORWARD
PIN L	PIN K	BACKWARD
PIN N	PIN M	REAR RISER UP
PIN M	PIN N	REAR RISER DOWN

**DIAGNOSIS AND TESTING (Continued)**

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**Fig. 1 Seat Motor Switch Connector**

1 - BLACK

**SEAT MOTOR SWITCH**

(1) Remove switch from mounting position.

(2) Using an ohmmeter, perform the Switch Continuity Tests below and refer to (Fig. 2) for Pin locations. If there is no continuity at any of the switch positions, replace switch.

**SEAT SWITCH CONTINUITY TEST**

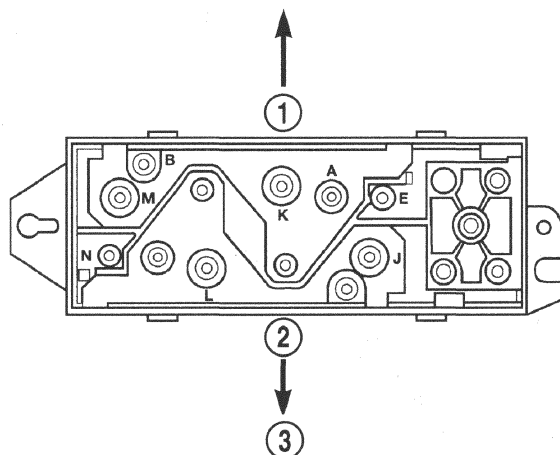
SWITCH POSITION	CONTINUITY BETWEEN
OFF	B-N, B-J, B-M, B-E, B-K, B-L
VERTICAL UP	B-M, B-E, A-N, A-J
VERTICAL DOWN	B-N, B-J, A-M, A-E
HORIZONTAL AFT	B-K, A-L
HORIZONTAL FORWARD	B-L, S-K
FRONT TILT UP	S-J, B-E
FRONT TILT DOWN	A-E, B-J
REAR TILT UP	A-N, B-N

**VOLTAGE**

The following test will determine whether or not voltage is continuous through the body harness to the switch.

(1) Remove power seat switch from mounting position and disconnect switch from wiring harness.

(2) Using a voltmeter, connect the ground lead to Pin 5 of the switch harness connector. Connect the positive lead to Pin 1. If battery voltage the ground and B+ circuit is OK. If no voltage check circuit breaker and repair as necessary.



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**Fig. 2 Power Seat Switch**

1 - UP

2 - DOWN

3 - TERMINALS SHOWN AS VIEWED FROM REAR OF SWITCH

**REMOVAL AND INSTALLATION****FRONT SEAT ASSEMBLY**

Refer to Group 23, Body for Front Seat Removal and Installation.

**POWER FRONT SEAT ADJUSTER****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable (Fig. 3).

(2) Remove Front Seat Assembly from vehicle. Refer to Group 23 Body, for Removal and Installation.

(3) Remove Front Seat Back. Refer to Group 23 Body for Removal and Installation

(4) Separate power seat switch and harness from seat adjuster.

(5) Remove four power seat adjuster mounting screws from cushion pan and remove from seat assembly.

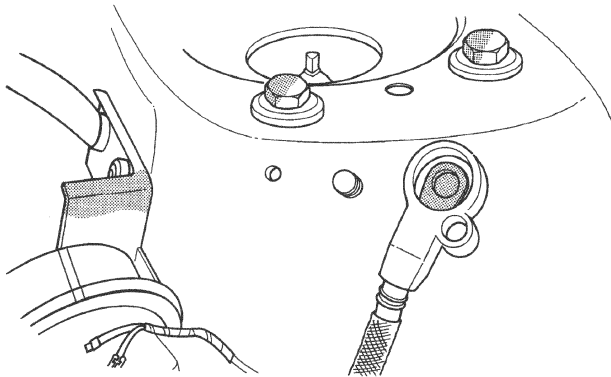
**INSTALLATION**

For installation, reverse the above procedures.



**REMOVAL AND INSTALLATION (Continued)****POWER FRONT SEAT SWITCH****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable (Fig. 3).



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**Fig. 3 Disconnect Battery Negative Remote Cable**

- (2) Remove left cushion side shield.
- (3) Disconnect wiring from switch.
- (4) Remove the seat and recliner switch knobs.
- (5) Remove attaching screws and switch from bezel.

**INSTALLATION**

For installation, reverse the above procedure.



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# POWER WINDOW SYSTEMS

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## DESCRIPTION AND OPERATION

### POWER WINDOW SYSTEMS

#### DESCRIPTION

The power window system allows each of the door windows to be raised and lowered electrically by actuating a switch on the trim panel of each respective door. A master switch on the driver side door trim panel allows the driver to raise or lower either front window. The power window system receives battery feed through a circuit breaker in the junction block, only when the ignition switch is in the On position.

The power window system includes the power window switches on each door trim panel, the circuit breaker in the junction block, and the power window motors inside each door. For service of mechanical components, such as the regulator, lift plate, window tracks, or glass refer to Group 23 - Body.

#### OPERATION

Front door window lift motors are of the permanent magnet type. A battery positive and negative connection to either of the two motor terminals will cause the motor to rotate in one direction. Reversing current through these same two connections will cause the motor to rotate in the opposite direction.

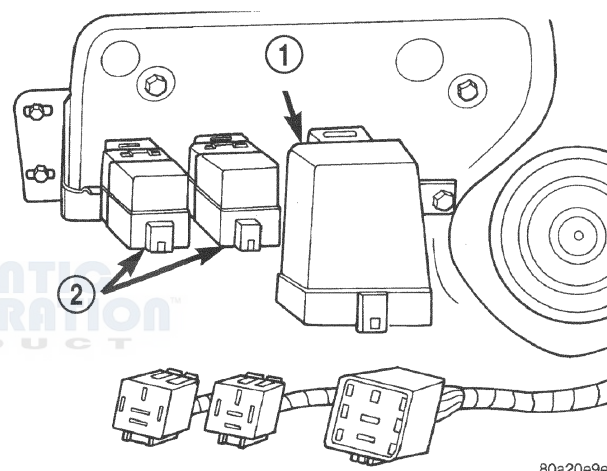
Each individual motor is grounded through the master switch.

### WINDOW DROP RELAY ASSEMBLY

#### DESCRIPTION

The Window Drop Relay Assembly allows the windows to be automatically lowered when the convertible top is raised or lowered.

It is mounted inside the drivers side door, behind the door trim panel.



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**Fig. 1 Window Drop Relay Assembly**

- 1 - WINDOW TIMER MODULE  
2 - WINDOW MOTOR RELAYS

#### OPERATION

The window timer module will lower the windows for 280 to 380 milliseconds when the top switch is pressed up or down. This will lower the windows approximately 1 to 3 inches so that the windows are clear of the top while raising or lowering.

## DIAGNOSIS AND TESTING

#### VOLTAGE

The following circuit test sequence determines whether or not voltage is continuous through the body harness to switch.

(1) Remove the driver door trim panel. Refer to Group 23, Body for proper procedures.

(2) Carefully separate wiring harness connector from switch body. Refer to Group 8W, Wiring Diagrams.

**DIAGNOSIS AND TESTING (Continued)**

(3) Using a voltmeter, connect the ground lead to the Pin 10 of the wiring harness connector.

(4) Using the positive lead, check Pin 1 of the harness connector for battery voltage. If OK, go to Window Switch Test below. If not OK, check 20 amp circuit breaker in the Junction Block, if the circuit breaker is OK, repair wire as necessary. For wiring, specific connector type and location, refer to Group 8W, Wiring Diagrams.

**WINDOW DROP RELAY ASSEMBLY CONDITIONS**

When testing for a voltage signal, use a digital voltmeter, because the signal will last only 280 to 380 milliseconds. Place the ignition switch in the run position with out engine running. Refer to Group 8W, Wiring Diagrams circuit and pin locations (Fig. 2).

**When pressing the top switch all windows do not lower**

(1) Check for battery voltage at Pin 1 and 2 of the window timer module wire connector. If OK, go to Step 2. If not OK, check circuit breaker top switch. Repair as necessary.

(2) Using an ohmmeter, check Pin 9 of the window timer module wire connector for ground. If OK, go to Step 3. If not OK, repair as necessary.

(3) Using a digital voltmeter, check Pin 7 of the window timer module wire connector for voltage signal for 280 to 380 milliseconds while pressing the top switch. If not OK, replace the window timer module. If OK, check power window circuit connections.

**When pressing the top switch the front window(s) do not lower**

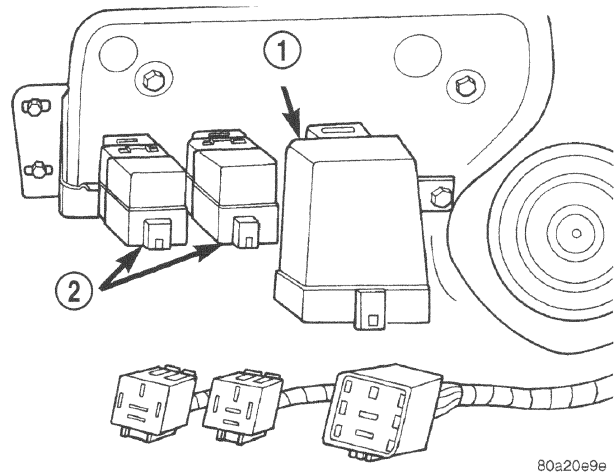
(1) Using a digital voltmeter, check Pin 4 of both window motor relay wire connectors for voltage signal while pressing the top switch. If there is a momentary voltage, go to Step 2. If not OK, window timer relay.

(2) Using an ohmmeter, check Pin 6 of the both window motor relays wire connector for ground. If OK, go to Step 3. If not OK, repair ground as necessary.

(3) Using an ohmmeter, check Pin 85 to Pin 86 of window motor relay with connector disconnected for open circuit. If OK, check power window circuit connections. If open circuit replace window motor relay.

**When pressing the top switch the rear window(s) do not lower**

(1) Using a digital voltmeter, check Pin 4 and Pin 6 of the window timer module wire connector for battery voltage while pressing the top switch. If no voltage replace the window timer module. If voltage, check power window circuit connections.



**Fig. 2 Power Drop Relay Assembly**

- 1 - WINDOW TIMER MODULE  
2 - WINDOW MOTOR RELAYS

**WINDOW MOTOR**

(1) Remove door trim panel, refer to Group 23 Body for removal procedures.

(2) Connect positive (+) lead from a test battery to either of the two motor terminals.

(3) Connect negative (-) lead from test battery to remaining motor terminal.

(4) The motor should now rotate in one direction to either move window up or down.

(a) If window happens to already be in full UP position and motor is connected so as to move it in UP direction no movement will be observed.

(b) Likewise, motor connected to move window in DOWN direction no movement will be observed if window is already in full DOWN position.

(c) Reverse battery leads in Step 1 and Step 2 and window should now move. If window does not move, remove motor. See below for motor removal from vehicle.

(5) If window moved completely up or down, the test leads should be reversed one more time to complete a full window travel inspection.

(6) If window does not move, check to make sure that it is free.

(7) It is necessary that the window be free to slide up and down in the glass channels. If the window is not free to move up and down, the window lift motor will not be able to move the glass.

(8) To determine if the glass is free is to disconnect the regulator from the glass lift plate. Remove the two attaching screws, and slide the window up and down by hand.

**WINDOW SWITCH**

For switch testing, remove the switch from its mounting, refer to Switch Removal. Using an ohm-

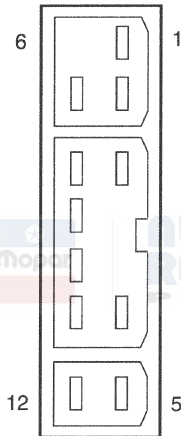


## DIAGNOSIS AND TESTING (Continued)

meter, refer to Window Switch Continuity Charts to determine if continuity is correct (Fig. 3) and (Fig. 4). If the results are not obtained, replace the switch.

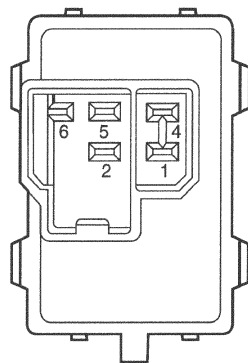
The master window switch has an Auto-Down feature. Actuation of the master switch to the second down position will move the drivers side window completely down. The electronic switch will automatically disconnect the motor approximately 1 second after the window bottoms out. Failure of the electronic switch to detect stall current, will cause the switch to disconnect after approximately 13 seconds. The auto down function can be canceled by any movement of the switch.

SWITCH POSITION		CONTINUITY BETWEEN TERMINALS
OFF		PIN 10 to 2
		PIN 10 to 3
		PIN 10 to 4
		PIN 10 to 7
		PIN 10 to 8
		PIN 10 to 9
		PIN 10 to 11
UP	DRIVER'S	PIN 1 to 7
		PIN 8 to 10
UP	RIGHT FRONT	PIN 1 to 12
		PIN 10 to 11
UP	LEFT REAR	PIN 3 to 10
		PIN 1 to 2
UP	RIGHT REAR	PIN 1 to 4
		PIN 9 to 10
DOWN	DRIVER'S	PIN 1 to 8
		PIN 7 to 10
DOWN	RIGHT FRONT	PIN 1 to 11
		PIN 10 to 12
DOWN	LEFT REAR	PIN 3 to 1
		PIN 2 to 10
DOWN	RIGHT REAR	PIN 1 to 9
		PIN 4 to 10



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Fig. 3 Master Window Switch



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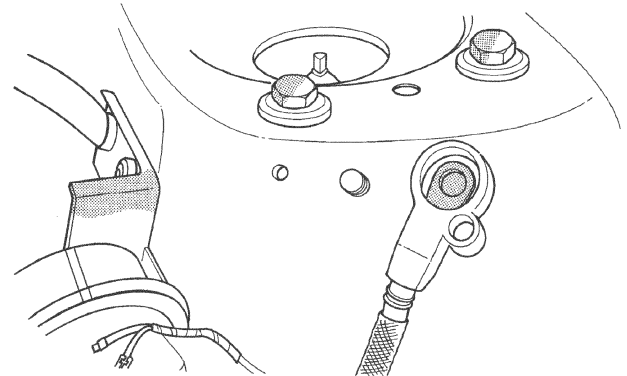
Fig. 4 Passenger Window Switch

## REMOVAL AND INSTALLATION

### WINDOW DROP RELAY ASSEMBLY

#### REMOVAL

- (1) Disconnect and isolate the battery negative remote cable (Fig. 5).



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Fig. 5 Battery Negative Remote Cable Removal

- (2) Remove door trim panel, refer to Group 23, Body for removal procedures.
- (3) Disconnect the wire connectors (Fig. 2).
- (4) Remove the attaching screws.
- (5) Remove relay assembly.

#### INSTALLATION

For installation, reverse the above procedures.

### WINDOW MOTOR

**WARNING: DO NOT HAVE ANY HANDS OR FINGERS IN SECTOR GEAR AREA WHERE THEY CAN BE PINCHED BY SMALL MOVEMENTS OF REGULATOR LINKAGE.**

#### REMOVAL

- (1) Move the window to the 3/4 down position, if possible.
- (2) Disconnect and isolate the battery negative remote cable (Fig. 5).
- (3) Remove door trim panel and window regulator, refer to Group 23 Body for removal procedures.

**WARNING: FAILURE TO CLAMP THE SECTOR GEAR TO THE MOUNTING PLATE WHEN REMOVING THE MOTOR CAN RESULT IN INJURY.**

- (4) Disconnect wiring connector from motor.
- (5) Secure the sector gear and mounting plate with a C clamp or similar clamping tool. This will prevent a sudden and forceful movement of the regulator when the motor is removed.

**REMOVAL AND INSTALLATION (Continued)**

(6) Remove three mounting screws that hold motor gearbox to regulator (Fig. 6).

(7) Remove motor from regulator.

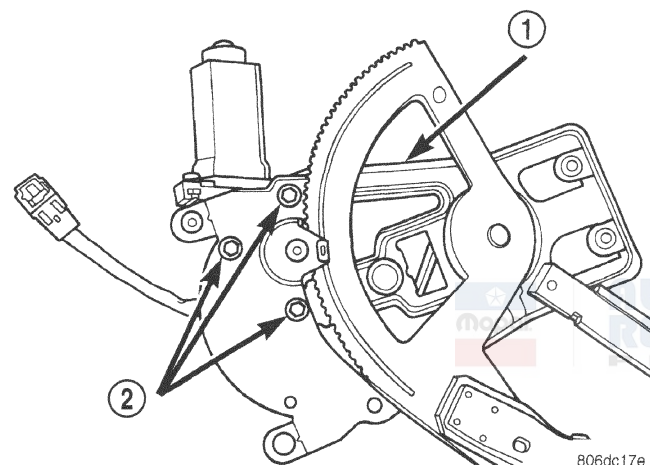
**INSTALLATION**

(1) Install new motor on regulator by positioning motor gearbox so that it engages regulator sector teeth.

(2) A slight rotational or rocking movement may be necessary to bring three motor gearbox screw holes into proper position.

(3) Install three gearbox screws and one tie down bracket screw, if applicable. Tighten to 8.4 to 13 N·m (74 to 115 in. lbs.) torque.

(4) Install regulator, using the switch, test operation of motor.

**Fig. 6 Motor Removal**

- 1 - CLAMP REGULATOR TO SECTOR GEAR
- 2 - MOTOR MOUNTING SCREWS

**WINDOW SWITCH AND BEZEL****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable (Fig. 5).

(2) Start at the rear center of the bezel. Using your fingers or a trim stick, lift the bezel upwards

and slightly inboard to disconnect the two rear clips (Fig. 7). Use care not to mar the door trim.

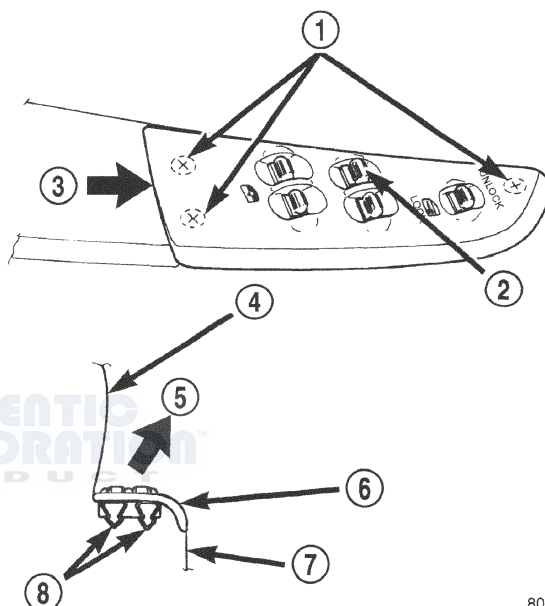
(3) With the rear of the bezel raised, pull the forward end up to release the third clip.

(4) Disconnect the power window switches and door lock switch wire connectors.

(5) Remove attaching screws and remove window switch.

**INSTALLATION**

For installation, reverse the above procedures.

**Fig. 7 Window Switch Bezel**

- 1 - LOCATION OF BEZEL TO DOOR TRIM CLIPS UNDERNEATH
- 2 - AUTO
- 3 - LIFT POINT
- 4 - DOOR TRIM
- 5 - LIFT UPWARD & INBOARD IN THE DIRECTION OF ARROW
- 6 - SWITCH & BEZEL ASSEMBLY
- 7 - DOOR TRIM (ARMREST AREA)
- 8 - CLIPS

# POWER MIRROR SYSTEMS

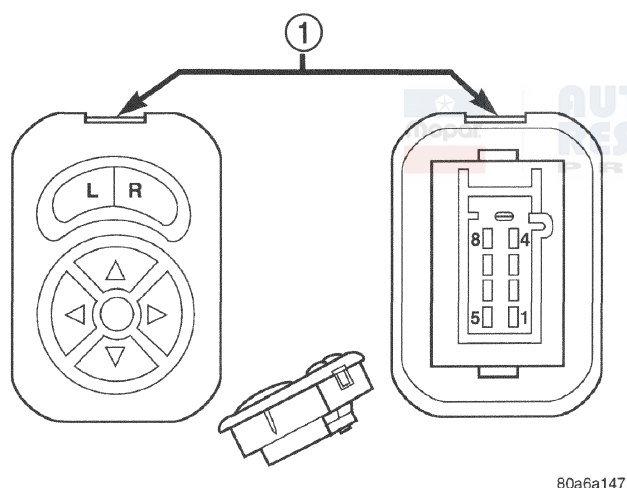
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## DESCRIPTION AND OPERATION

### POWER MIRROR SYSTEMS

#### DESCRIPTION



**Fig. 1 Power Mirror Switch**

1 - REMOVAL SLOT

Power mirrors are controlled by a single switch located on the driver's door.

#### OPERATION

The switch has a rocker button marked L (left) and R (right) for mirror selection and four buttons for mirror direction movement.

The motors which operate the mirrors are part of the mirror assembly and cannot be replaced separately.

**NOTE: Power mirrors are only operational with the ignition "ON".**

## HEATED MIRRORS

#### DESCRIPTION

Heated mirrors are available with Power Mirrors and Rear Window Defogger only.

#### OPERATION

The heated mirror is controlled by the rear window defogger switch. The only time that the heated mirror is on is when the rear window defogger is on. The mirror should become warm to the touch.

## DIAGNOSIS AND TESTING

### HEATED MIRROR

(1) Using a ohmmeter, check Pin 1 of the mirror motor harness connector for continuity to ground. If OK, go to Step 2. If not OK, repair as necessary. Refer to Group 8W, Wiring Diagrams.

(2) Activate the rear window defogger switch, use a voltmeter and check Pin 2 for battery voltage.

(a) If OK, go to Step 3. If not OK, check fuse 5 in the Junction Block and repair as necessary.

(b) Check rear window defogger switch, refer to Group 8N, Rear Window Defogger. If OK, go to Step c. If not OK, replace HVAC control.

(c) If no voltage repair wire as necessary. Refer to Group 8W, Wiring Diagrams.

(3) Remove mirror glass and check wires. If wires are OK, replace mirror glass. If not OK, repair as necessary or replace mirror.

### MIRROR MOTOR

(1) Remove door trim panel. Refer to Group 23, Body.

(2) Disconnect wire connector from the switch.

(3) Using two jumper wires, one connected to a 12 volt battery source, and the other connected to a good

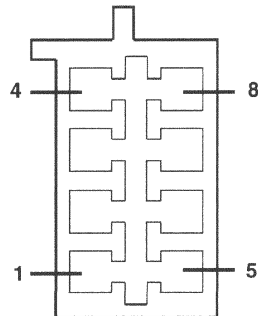


**DIAGNOSIS AND TESTING (Continued)**

body ground. Refer to the Mirror Test (Fig. 2) for appropriate mirror response, using the mirror switch wiring harness connector.

(4) If test results are not obtained as shown in the (Fig. 2), check for open or shorted circuit, or replace mirror assembly as necessary.

MIRROR SWITCH HARNESS CONNECTOR			
12 Volt	Ground	Mirror Reaction	
		Left	Right
PIN 4	PIN 5		UP
PIN 8	PIN 5	UP	
PIN 5	PIN 4		DOWN
PIN 5	PIN 8	DOWN	
PIN 6	PIN 3		RIGHT
PIN 6	PIN 7	RIGHT	
PIN 3	PIN 6		LEFT
PIN 7	PIN 6	LEFT	

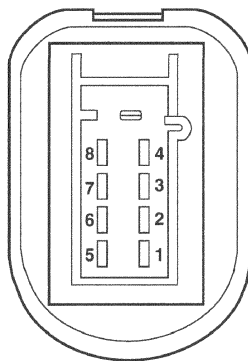


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**Fig. 2 Mirror Motor Test****MIRROR SWITCH**

- (1) Remove switch from door trim panel.
- (2) Disconnect wire connector.
- (3) Using an ohmmeter, test for continuity between the terminals of the switch as shown in the Mirror Switch Test (Fig. 3).
- (4) If test results are not obtained as shown in the (Fig. 3), replace the switch.

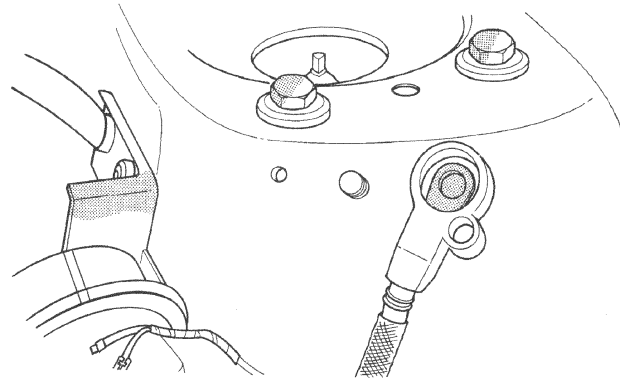
SWITCH POSITION Move Button	CONTINUITY BETWEEN TERMINALS
<b>Mirror in L Position</b>	
▲	PIN 1 to 5 PIN 2 to 8
▶	PIN 1 to 7 PIN 2 to 6
▼	PIN 1 to 8 PIN 2 to 5
◀	PIN 1 to 6 PIN 2 to 7
<b>Mirror in R Position</b>	
▲	PIN 1 to 5 PIN 2 to 4
▶	PIN 1 to 3 PIN 2 to 6
▼	PIN 1 to 4 PIN 2 to 5
◀	PIN 1 to 6 PIN 2 to 3



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**Fig. 3 Mirror Switch Test****REMOVAL AND INSTALLATION****INSIDE MIRROR/READING LAMP ASSEMBLY****REMOVAL**

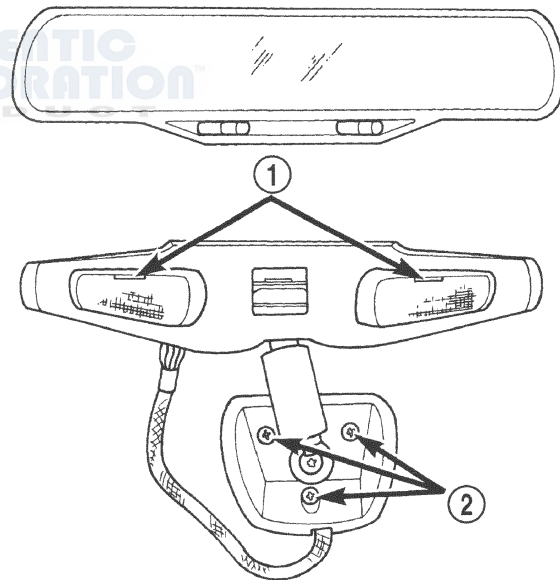
- (1) Disconnect and isolate the battery negative remote cable (Fig. 4).



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**Fig. 4 Battery Negative Remote Cable Removal**

- (2) Remove attaching screws from header (Fig. 5).



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**Fig. 5 Inside Mirror/Reading Lamps**

- 1 - PRY OFF LENS
- 2 - ATTACHING SCREWS

- (3) Lower mirror, and disconnect the wire harness connector.

- (4) Remove mirror assembly.

**INSTALLATION**

For installation, reverse the above procedure.

**REMOVAL AND INSTALLATION (Continued)****INSIDE MIRROR/READING LAMP BULB/LENS****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable (Fig. 4).

(2) Using a small thin blade tool, pry at the center of the lens nearest the mirror to remove lens (Fig. 5).

(3) Remove lamp and replace if necessary.

**INSTALLATION**

Install lens by setting into position and apply pressure until it is locked into position.

**OUTSIDE MIRROR ASSEMBLY**

Refer to Group 23-Body, for Outside Mirror Removal and Installation.

**POWER MIRROR SWITCH****REMOVAL**

(1) Disconnect and isolate the battery negative remote cable (Fig. 4).

(2) Place a small flat blade tool into the slot above the L - R selector end of the switch. Pushing against the switch and pulling upward will release the mounting clip located directly below. This will allow the switch to be release from the door trim panel.

(3) Disconnect wire connector.

**INSTALLATION**

For installation, reverse the above procedures.



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# CHIME/BUZZER WARNING SYSTEMS

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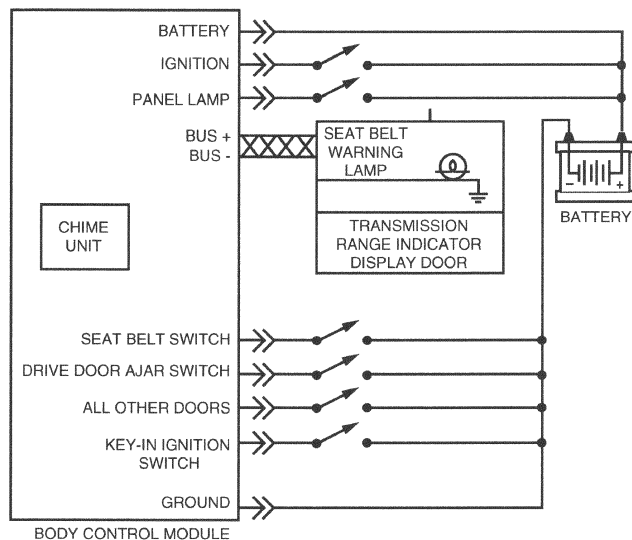
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FASTEN SEAT BELTS .....	3	SEAT BELT BUCKLE .....	3
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## DESCRIPTION AND OPERATION

### CHIME/BUZZER WARNING SYSTEMS

**WARNING: ON VEHICLES EQUIPPED WITH AN AIR-BAG, REFER TO GROUP 8M, PASSIVE RESTRAINT SYSTEMS FOR STEERING WHEEL REMOVAL AND INSTALLATION.**

#### DESCRIPTION



80b099bf

**Fig. 1 Chime Buzzer Warning System Schematic**

The chime warning/reminder system includes signals for fasten seat belts, exterior lamps left ON, key left in ignition and door ajar.

For diagnosis and testing, use the DRB III® scan tool and the proper Body Diagnostic Procedures Manual.

## OPERATION

### DOOR AJAR CHIME

The BCM will sound an audible chime when the key is in the ignition and the drivers door is open. This is to prevent partial closing of vehicle doors.

An audible chime will sound when the vehicle begins to move and the transmission range indicator display will indicate DOOR.

### FASTEN SEAT BELTS

A warning lamp on the instrument panel, and an audible chime tone are used as the fasten seat belt warning/reminder.

### EXTERIOR LAMPS LEFT ON

An audible chime tone that indicates the exterior lamps were left on.

### KEY LEFT IN IGNITION

An audible chime tone that indicates the key was left in ignition.

## DIAGNOSIS AND TESTING

### CHIME DIAGNOSTIC CONDITIONS

For Removal and Installation of Junction Block (JB), refer to Group 8O, Power Distribution Systems.

For Removal and Installation of Body Control Module (BCM), refer to Group 8E, Instrument Panel and Systems.

### NO TONE WHEN IGNITION SWITCH IS TURNED ON AND DRIVERS SEAT BELT IS UNBUCKLED AND FULLY RETRACTED

(1) Check driver's seat belt retractor switch for a ground when belt is retracted.



**DIAGNOSIS AND TESTING (Continued)**

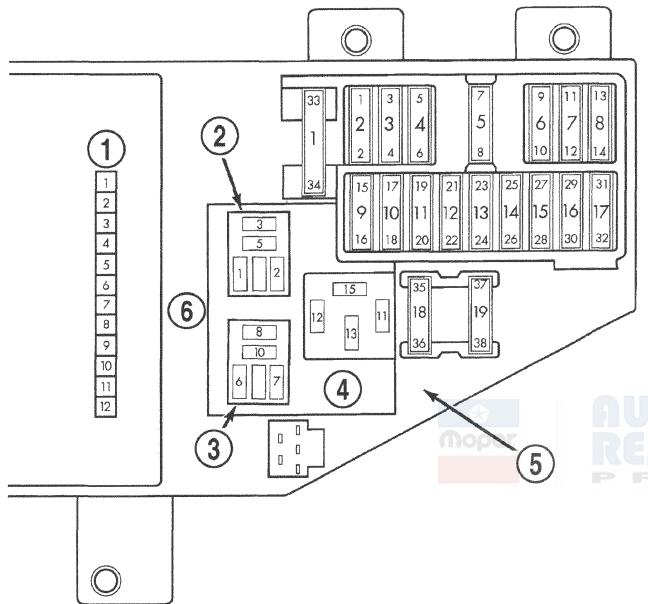
(2) Use scan tool to perform CCD diagnostics on Body Control Module for battery, ignition and seat belt switch inputs.

(3) Use scan tool to perform actuator diagnostics on Body Control Module Chime.

(4) Check for tone in any other function.

(5) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module (Fig. 2). Refer to Group 8W, Wiring Diagrams for terminal location.

(6) If voltage not OK, repair as necessary.



958U-2

**Fig. 2 Junction Block Connector to the BCM**

- 1 - BODY CONTROL MODULE
- 2 - H/LP RELAY
- 3 - HORN RELAY
- 4 - EBL
- 5 - CIRCUIT BREAKERS
- 6 - HORN

**NO FASTEN SEAT BELT LAMP WHEN IGNITION SWITCH IS TURNED ON**

(1) Use DRB III® scan tool to perform CCD diagnostics on Body Control Module for battery and ignition switch inputs.

(2) Check for burned out bulb.

(3) Using the DRB III® scan tool, do the actuator test on cluster. Refer to proper Body Diagnostic Procedures Manual.

(4) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for terminal location.

(5) If voltage not OK, repair as necessary.

**FASTEN SEAT BELT LAMP OR TONE CONTINUE FOR MORE THAN 10 SECONDS AFTER SEAT BELTS ARE FASTENED AND IGNITION ON**

(1) Use scan tool to perform CCD diagnostics on Body Control Module for battery and ignition switch input.

(2) Inspect Body Control Module connectors and wires for proper connection.

**NO TONE OR DOOR INDICATED IN PLACE OF ODOMETER WHEN A DOOR IS AJAR AND VEHICLE BEGINS MOVING**

The vehicle must be moving for the chime to occur. However the door indicator will come ON regardless of the vehicle movement. The CCD bus, Transmission Control Module (TCM) and Powertrain Control Module (PCM) must be operational.

(1) Check all door jamb switches.

(2) Use DRB III® scan tool to perform CCD diagnostics on Body Control Module for battery and ignition switch input

(3) Inspect Body Control Module connectors and wires for proper connection.

(4) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for the location of the terminals.

(5) If voltage not OK, repair as necessary.

**NO TONE WHEN HEADLAMPS ARE ON, IGNITION SWITCH IS OFF AND DRIVER'S DOOR IS OPEN.**

(1) Check left door jamb switch for good ground when driver's door is open.

(2) Use DRB III® scan tool to perform CCD diagnostics on Body Control Module for battery, ignition switch input, headlamp and driver's door input and Chime Output Test.

(3) Check headlamp switch.

(4) Inspect Body Control Module connectors and wires for proper connection.

(5) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for terminal location.

(6) If voltage not OK, repair as necessary.

**NO TONE WHEN IGNITION KEY IS LEFT IN IGNITION SWITCH AND IT IS IN THE OFF POSITION WITH DRIVER'S DOOR IS OPEN**

(1) Check left door jamb switch for good ground when drivers door is open.

(2) Use DRB III® scan tool to perform CCD diagnostics on Body Control Module for battery, ignition

**DIAGNOSIS AND TESTING (Continued)**

switch input, key-in-switch and driver's door input and Chime Output Test.

(3) Check key-in switch.

(4) Inspect Body Control Module connectors and wires for proper connection.

(5) Remove Body Control Module from Junction Block. Check for battery voltage at terminal JB-12 and ignition feed at terminal JB-6 of Body Control Module. Refer to Group 8W, Wiring Diagrams for terminal location.

(6) If voltage not OK, repair as necessary.

**CHIMES CONTINUE WHEN HEADLAMPS ARE TURNED OFF AND/OR KEY IS REMOVED FROM IGNITION**

(1) Use DRB III® scan tool to perform CCD diagnostics on Body Control Module for headlamp or key-in-ignition inputs.

(2) Check wiring for a grounded condition between key-in switch and Body Control Module. Check headlamp switch to Body Control Module wiring for short to battery.

(3) Inspect Body Control Module connectors and wires for proper connection.

**EXTERIOR LAMPS LEFT ON**

To test the headlamps left on function, turn ignition off, turn exterior lamps on with driver's door open. Chime should sound until headlamps are turned off or drivers door is closed.

**FASTEN SEAT BELTS**

To test, the ignition switch must be in the off position before testing the fasten seat belts. Turn the ignition switch to the ON position with the driver's

seat belt unbuckled and fully retracted. The seat belt warning lamp should light for 4 to 8 seconds and the tone should sound 4 to 8 seconds.

**KEY LEFT IN IGNITION SWITCH**

To test the key left in ignition function:

- The ignition switch must be in the OFF position with key in ignition.
- Driver's door open.
- Chime should sound until key is removed from ignition or drivers door is closed.

**REMOVAL AND INSTALLATION****BODY CONTROL MODULE (BCM)**

Refer to Group 8E, Instrument Panel and Systems for Removal and Installation.

**HEADLAMP SWITCH**

Refer to Group 8E, Instrument Panel and Systems.

**JUNCTION BLOCK (JB)**

Refer to Group 8O, Power Distribution Systems for Removal and Installation.

**KEY-IN SWITCH**

The Key-in switch is built into the ignition switch assembly. Should the Key-in switch require service, the ignition switch assembly must be replaced. Refer to Group 8D, Ignition System for service procedures.

**SEAT BELT BUCKLE**

Refer to Group 23, Body for service procedures.

# WIRING DIAGRAMS

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AUTHENTIC  
RESTORATION  
PRODUCT



## 8W-01 GENERAL INFORMATION

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## DESCRIPTION AND OPERATION

### INTRODUCTION

DaimlerChrysler wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use DaimlerChrysler wiring diagrams to diagnose and repair a DaimlerChrysler vehicle, it is important to understand all of their features and characteristics.

Diagrams are arranged such that the power (B+) side of the circuit is placed near the top of the page, and the ground (B-) side of the circuit is placed near the bottom of the page.

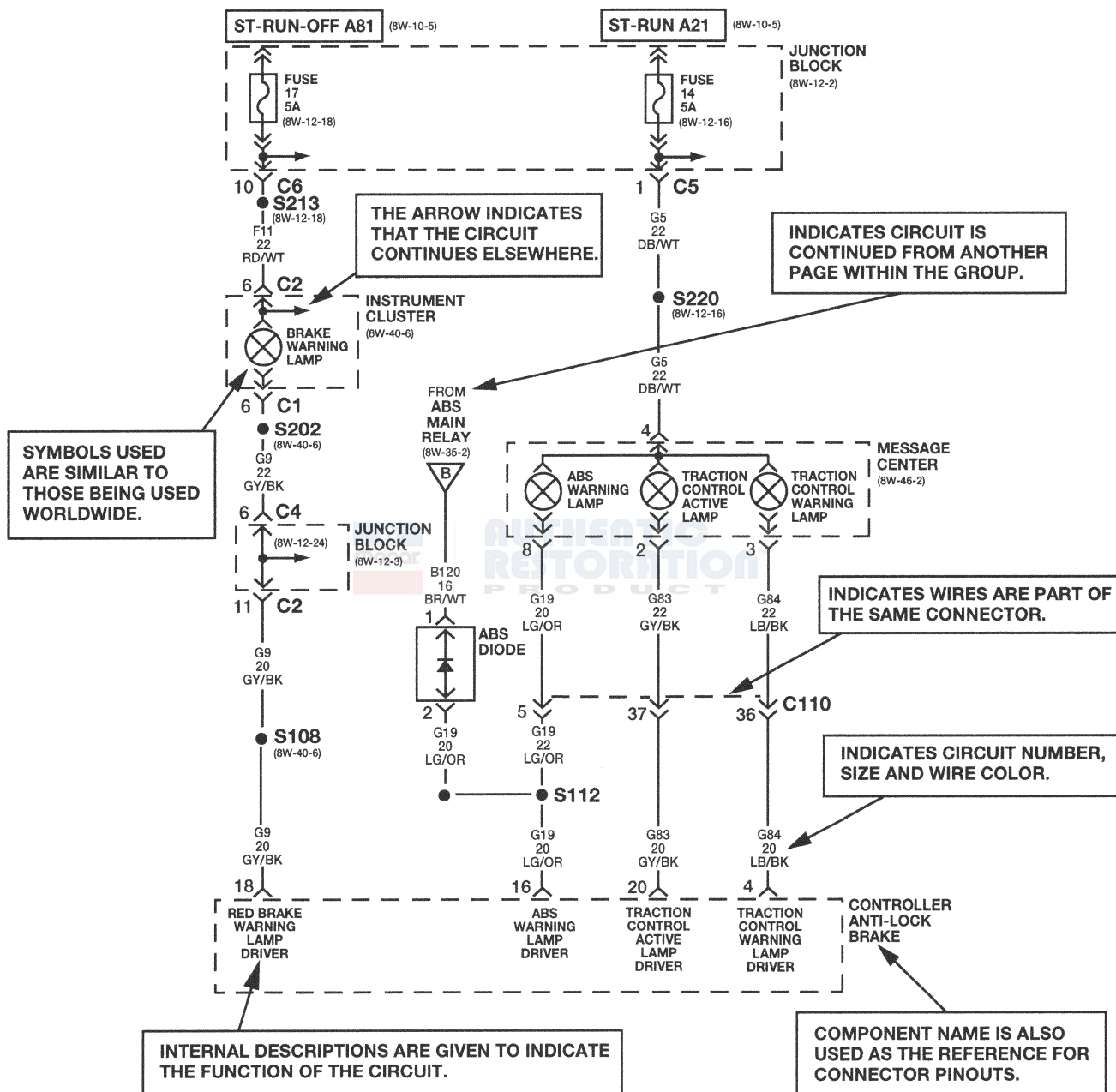
All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the ignition.

Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around a component indicates that the component being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

It is important to realize that no attempt is made on the diagrams to represent components and wiring as they appear on the vehicle. For example, a short piece of wire is treated the same as a long one. In addition, switches and other components are shown as simply as possible, with regard to function only.

**DESCRIPTION AND OPERATION (Continued)**

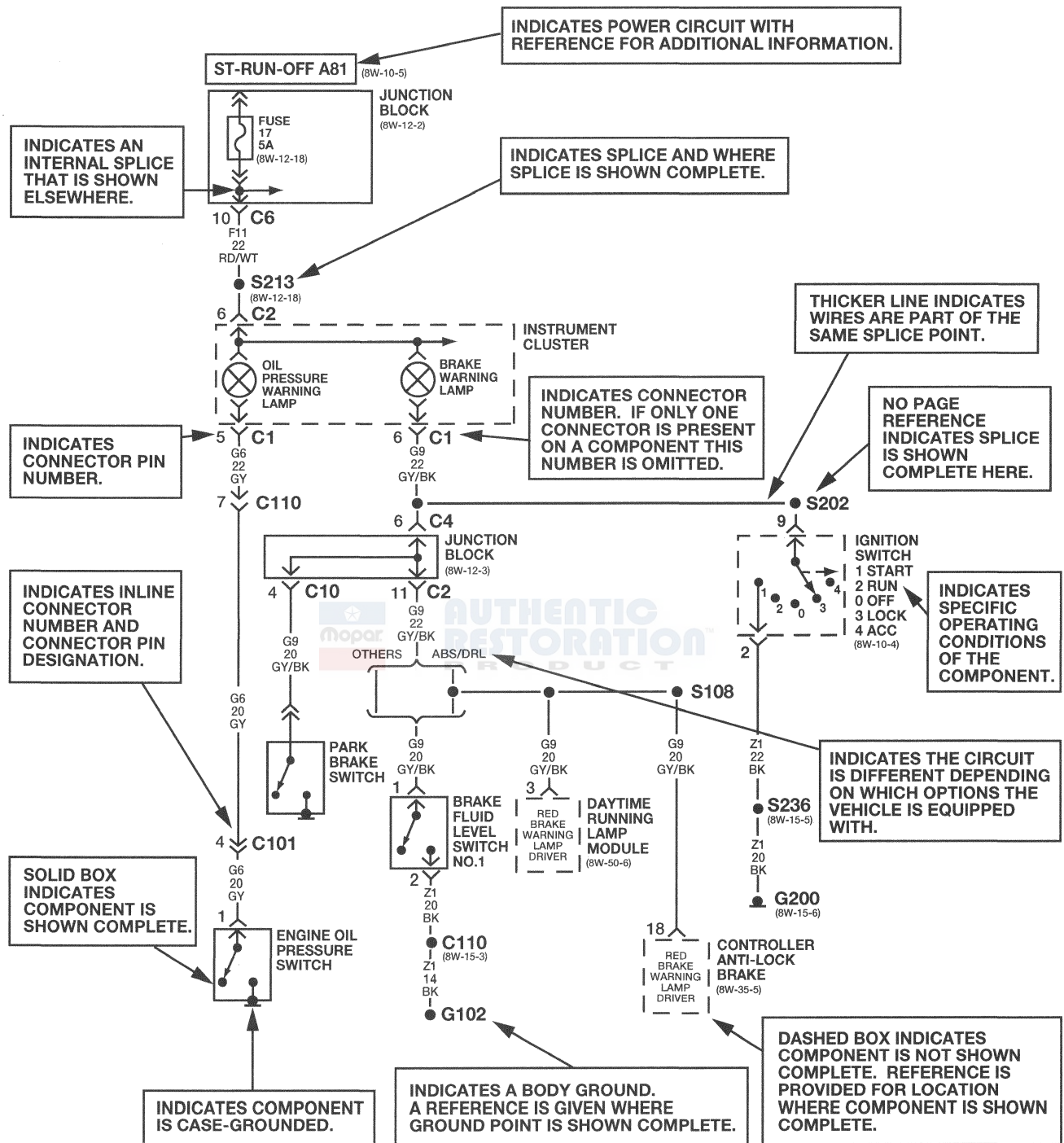
DIAGRAMS ARE ARRANGED WITH THE POWER B+ SIDE OF THE CIRCUIT NEAR THE TOP OF THE PAGE, AND THE GROUND SIDE OF THE CIRCUIT NEAR THE BOTTOM OF THE PAGE.



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*The System shown here is an EXAMPLE ONLY.  
It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.*

## DESCRIPTION AND OPERATION (Continued)



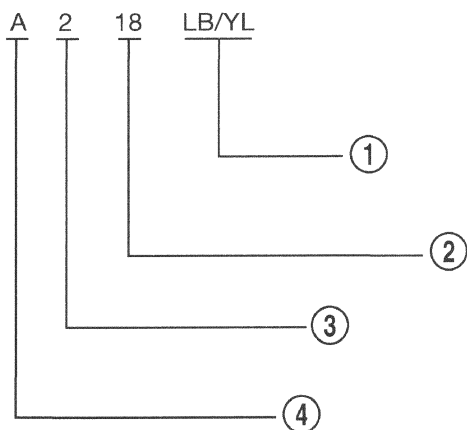
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*The System shown here is an EXAMPLE ONLY.  
It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.*



**DESCRIPTION AND OPERATION (Continued)****CIRCUIT INFORMATION**

Each wire shown in the diagrams contains a code which identifies the main circuit, part of the main circuit, gage of wire, and color (Fig. 1).



80aff571

**Fig. 1 Wire Code Identification**

- 1 - COLOR OF WIRE (LIGHT BLUE WITH YELLOW TRACER)
- 2 - GAUGE OF WIRE (18 GAUGE)
- 3 - PART OF MAIN CIRCUIT (VARIES DEPENDING ON EQUIPMENT)
- 4 - MAIN CIRCUIT IDENTIFICATION

**WIRE COLOR CODE CHART**

COLOR CODE	COLOR	STANDARD TRACER COLOR
BL	BLUE	WT
BK	BLACK	WT
BR	BROWN	WT
DB	DARK BLUE	WT
DG	DARK GREEN	WT
GY	GRAY	BK
LB	LIGHT BLUE	BK
LG	LIGHT GREEN	BK
OR	ORANGE	BK
PK	PINK	BK or WT
RD	RED	WT
TN	TAN	WT
VT	VIOLET	WT
WT	WHITE	BK
YL	YELLOW	BK
*	WITH TRACER	

**CIRCUIT FUNCTIONS**

All circuits in the diagrams use an alpha/numeric code to identify the wire and its function. To identify which circuit code applies to a system, refer to the Circuit Identification Code Chart. This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

**CIRCUIT IDENTIFICATION CODE CHART**

CIRCUIT	FUNCTION
A	BATTERY FEED
B	BRAKE CONTROLS
C	CLIMATE CONTROLS
D	DIAGNOSTIC CIRCUITS
E	DIMMING ILLUMINATION CIRCUITS
F	FUSED CIRCUITS
G	MONITORING CIRCUITS (GAUGES)
H	OPEN
I	NOT USED
J	OPEN
K	POWERTRAIN CONTROL MODULE
L	EXTERIOR LIGHTING
M	INTERIOR LIGHTING
N	NOT USED
O	NOT USED
P	POWER OPTION (BATTERY FEED)
Q	POWER OPTIONS (IGNITION FEED)
R	PASSIVE RESTRAINT
S	SUSPENSION/STEERING
T	TRANSMISSION/TRANSAXLE/ TRANSFER CASE
U	OPEN
V	SPEED CONTROL, WIPER/WASHER
W	OPEN
X	AUDIO SYSTEMS
Y	OPEN
Z	GROUND

**DESCRIPTION AND OPERATION (Continued)****SECTION IDENTIFICATION**

The wiring diagrams are grouped into individual sections. If a component is most likely found in a particular group, it will be shown complete (all wires, connectors, and pins) within that group. For example, the Auto Shutdown Relay is most likely to be found in Group 30, so it is shown there complete. It can, however, be shown partially in another group if it contains some associated wiring.



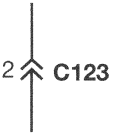
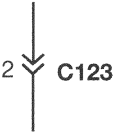



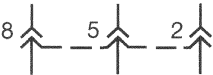












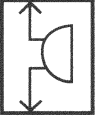
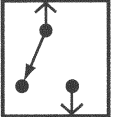
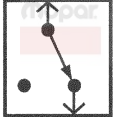




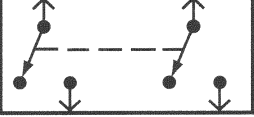


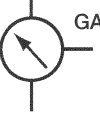

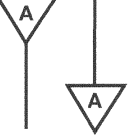





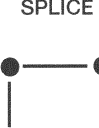

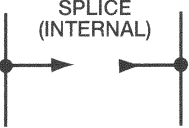





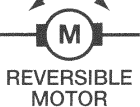



**SYMBOLS**

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world

GROUP	TOPIC
8W-01 thru 8W-09	General Information and Diagram Overview
8W-10 thru 8W-19	Main Sources of Power and Vehicle Grounding
8W-20 thru 8W-29	Starting and Charging
8W-30 thru 8W-39	Powertrain/Drivetrain Systems
8W-40 thru 8W-49	Body Electrical items and A/C
8W-50 thru 8W-59	Exterior Lighting, Wipers, and Trailer Tow
8W-60 thru 8W-69	Power Accessories
8W-70	Splice Information
8W-80	Connector Pin Outs
8W-90	Connector Locations (including grounds)
8W-95	Splice Locations




## DESCRIPTION AND OPERATION (Continued)

 BATTERY  GENERATOR STATOR COILS	 IN-LINE CONNECTORS 2 C123  2 C123
 FUSIBLE LINK  FUSE  CIRCUIT BREAKER	 MULTIPLE CONNECTOR 8 5 2 C123  MALE CONNECTOR 4 C1  FEMALE CONNECTOR 6 C3
 BATT A0 HOT BAR  CHOICE BRACKET         (8W-30-10) PAGE REFERENCE	 SINGLE FILAMENT LAMP  DUAL FILAMENT LAMP  ANTENNA
 CLOCKSPrING  GROUND G101  SCREW TERMINAL	 NPN TRANSISTOR  PNP TRANSISTOR  TONE GENERATOR
 OPEN SWITCH  CLOSED SWITCH	 LED  PHOTODIODE  DIODE  ZENER DIODE
 GANGED SWITCH  SLIDING DOOR CONTACT	 OXYGEN SENSOR  GAUGE  PIEZOELECTRIC CELL
 WIRE ORIGIN & DESTINATION SHOWN WITHIN CELL  WIRE DESTINATION SHOWN IN ANOTHER CELL	 RESISTOR  POTENTIOMETER  VARIABLE RESISTOR  HEATER ELEMENT
 EXTERNAL SPLICE S350  INTERNAL SPLICE  INCOMPLETE SPLICE (INTERNAL)	 NON-POLARIZED CAPACITOR  POLARIZED CAPACITOR  VARIABLE CAPACITOR
 ONE SPEED MOTOR  TWO SPEED MOTOR  REVERSIBLE MOTOR	 COIL  SOLENOID  SOLENOID VALVE

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**DESCRIPTION AND OPERATION (Continued)****CONNECTOR INFORMATION**

**CAUTION:** Not all connectors are serviced. Some connectors are serviced only with a harness. A typical example might be the Supplemental Restraint System connectors. Always check parts availability before attempting a repair.

**IDENTIFICATION**

In-line connectors are identified by a number, as follows:

- In-line connectors located on the **engine compartment harness** are **C100** series numbers.
- Connectors located on the **instrument panel harness** are **C200** series numbers.
- Connectors located on the **body harness** are **C300** series numbers.
- **Jumper harness connectors** are **C400** series numbers.
- **Grounds and ground connectors** are identified with a **"G"** and follow the same series numbering as the in-line connector.

Component connectors are identified by the component name instead of a number. Multiple connectors on a component use a C1, C2, etc. identifier.

**LOCATIONS**

Section 8W-90 contains connector/ground location illustrations. The illustrations contain the connector name (or number)/ground number and component identification. Connector/ground location charts in Section 8W-90 reference the illustration number for components and connectors.

Section 8W-80 shows each connector and the circuits involved with that connector. The connectors are identified using the name/number on the Diagram pages.

**SPLICE LOCATIONS**

Splice Location charts in Section 8W-70 show the entire splice, and provide references to other sections the splice serves.

Section 8W-95 contains illustrations that show the general location of the splices in each harness. The illustrations show the splice by number, and provide a written location.

**NOTES, CAUTIONS, and WARNINGS**

Throughout this group additional important information is presented in three ways; Notes, Cautions, and Warnings.

**NOTES** are used to help describe how switches or components operate to complete a particular circuit. They are also used to indicate different conditions

that may appear on the vehicle. For example, an up-to and after condition.

**CAUTIONS** are used to indicate information that could prevent making an error that may damage the vehicle.

**WARNINGS** provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

**WARNING: ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.**

**WARNING: USE SAFETY STANDS ANYTIME A PROCEDURE REQUIRES BEING UNDER A VEHICLE.**

**WARNING: BE SURE THAT THE IGNITION SWITCH ALWAYS IS IN THE OFF POSITION, UNLESS THE PROCEDURE REQUIRES IT TO BE ON.**

**WARNING: SET THE PARKING BRAKE WHEN WORKING ON ANY VEHICLE. AN AUTOMATIC TRANSMISSION SHOULD BE IN PARK. A MANUAL TRANSMISSION SHOULD BE IN NEUTRAL.**

**WARNING: OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA.**

**WARNING: KEEP AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE FAN AND BELTS.**

**WARNING: TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD(S), TAIL PIPE, CATALYTIC CONVERTER, AND MUFFLER.**

**WARNING: DO NOT ALLOW FLAME OR SPARKS NEAR THE BATTERY. GASES ARE ALWAYS PRESENT IN AND AROUND THE BATTERY.**

**WARNING: ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY, AND LOOSE CLOTHING.**

**TAKE OUTS**

The abbreviation T/O is used in the component location section to indicate a point in which the wiring harness branches out to a component.

## DESCRIPTION AND OPERATION (Continued)

### ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol (Fig. 2) is used to indicate this. When handling any component with this symbol comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the part is ESD sensitive, assume that it is.

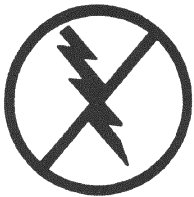
(1) Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.

(2) Avoid touching electrical terminals of the part, unless instructed to do so by a written procedure.

(3) When using a voltmeter, be sure to connect the ground lead first.

(4) Do not remove the part from its protective packing until it is time to install the part.

(5) Before removing the part from its package, ground the package to a known good ground on the vehicle.



948W-193

**Fig. 2 Electrostatic Discharge Symbol**

## DIAGNOSIS AND TESTING

### TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below.

- **Jumper Wire** - This is a test wire used to connect two points of a circuit. It can be used to bypass an open in a circuit.

**WARNING: NEVER USE A JUMPER WIRE ACROSS A LOAD, SUCH AS A MOTOR, CONNECTED BETWEEN A BATTERY FEED AND GROUND.**

- **Voltmeter** - Used to check for voltage on a circuit. Always connect the black lead to a known good ground and the red lead to the positive side of the circuit.

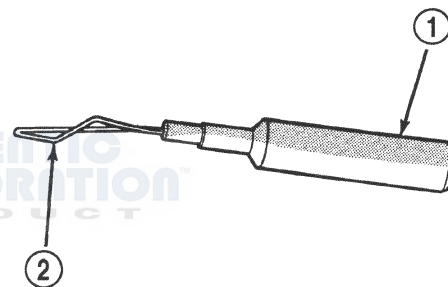
**CAUTION: Most of the electrical components used in today's vehicle are solid state. When checking**

**voltages in these circuits use a meter with a 10-megohm or greater impedance rating.**

- **Ohmmeter** - Used to check the resistance between two points of a circuit. Low or no resistance in a circuit means good continuity.

**CAUTION: - Most of the electrical components used in today's vehicle are Solid State. When checking resistance in these circuits use a meter with a 10-megohm or greater impedance rating. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle electrical system can cause damage to the equipment and provide false readings.**

- **Probing Tools** - These tools are used for probing terminals in connectors (Fig. 3). Select the proper size tool from Special Tool Package 6807, and insert it into the terminal being tested. Use the other end of the tool to insert the meter probe.



948W-233

**Fig. 3 Probing Tool**

- 1 - SPECIAL TOOL 6801  
2 - PROBING END

### INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem. Before condemning a component or wiring assembly check the following items.

- Connectors are fully seated
- Spread terminals, or terminal push out
- Terminals in the wiring assembly are fully seated into the connector/component and locked in position
- Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
- Damaged connector/component casing exposing the item to dirt and moisture
- Wire insulation that has rubbed through causing a short to ground
- Some or all of the wiring strands broken inside of the insulation covering.
- Wiring broken inside of the insulation

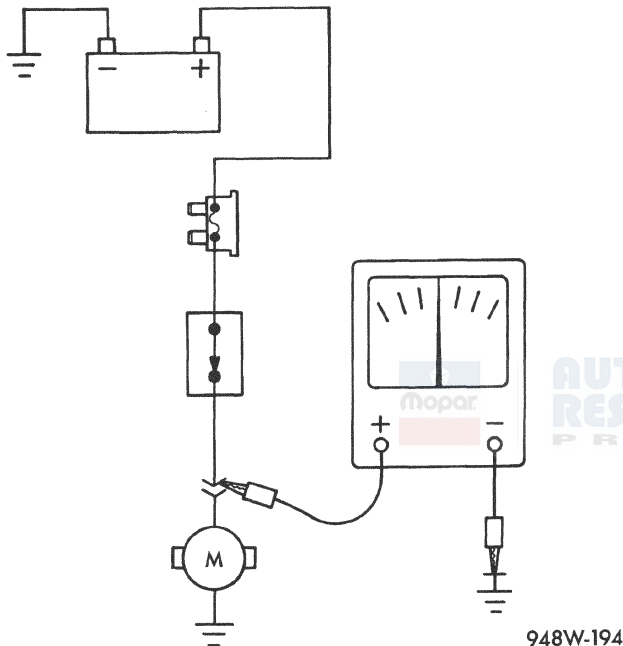
**DIAGNOSIS AND TESTING (Continued)****TROUBLESHOOTING TESTS**

Before beginning any tests on a vehicle's electrical system use the Wiring Diagrams and study the circuit. Also refer to the Troubleshooting Wiring Problems in this section.

**TESTING FOR VOLTAGE POTENTIAL**

(1) Connect the ground lead of a voltmeter to a known good ground (Fig. 4).

(2) Connect the other lead of the voltmeter to the selected test point. The vehicle ignition may need to be turned ON to check voltage. Refer to the appropriate test procedure.



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**Fig. 4 Testing for Voltage Potential****TESTING FOR CONTINUITY**

(1) Remove the fuse for the circuit being checked or, disconnect the battery.

(2) Connect one lead of the ohmmeter to one side of the circuit being tested (Fig. 5).

(3) Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.

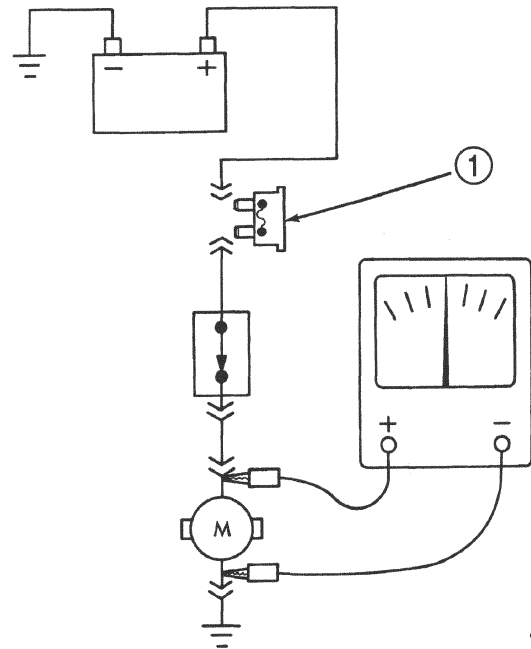
**TESTING FOR A SHORT TO GROUND**

(1) Remove the fuse and disconnect all items involved with the fuse.

(2) Connect a test light or a voltmeter across the terminals of the fuse.

(3) Starting at the fuse block, wiggle the wiring harness about six to eight inches apart and watch the voltmeter/test lamp.

(4) If the voltmeter registers voltage or the test lamp glows, there is a short to ground in that general area of the wiring harness.



948W-195

**Fig. 5 Testing for Continuity**

1 - FUSE REMOVED FROM CIRCUIT

**TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS**

(1) Refer to the wiring diagrams and disconnect or isolate all items on the suspected fused circuits.

(2) Replace the blown fuse.

(3) Supply power to the fuse by turning ON the ignition switch or re-connecting the battery.

(4) Start connecting the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

**TESTING FOR A VOLTAGE DROP**

(1) Connect the positive lead of the voltmeter to the side of the circuit closest to the battery (Fig. 6).

(2) Connect the other lead of the voltmeter to the other side of the switch or component.

(3) Operate the item.

(4) The voltmeter will show the difference in voltage between the two points.

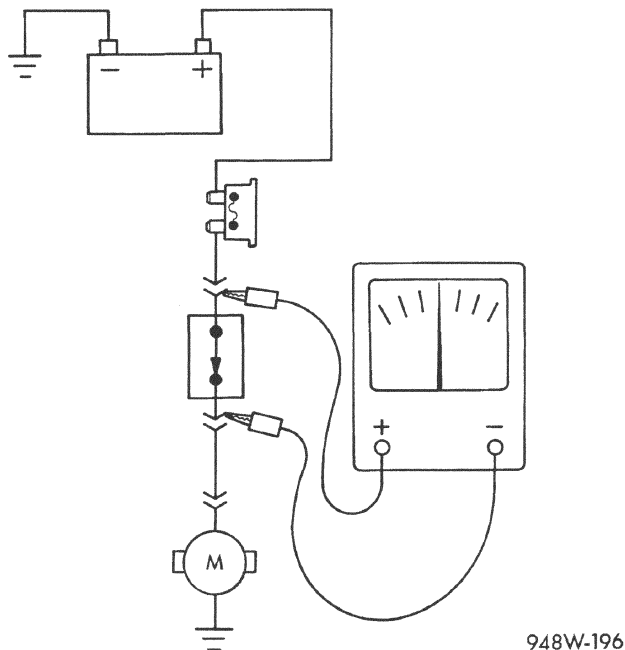
**TROUBLESHOOTING WIRING PROBLEMS**

When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

(1) Verify the problem.



## DIAGNOSIS AND TESTING (Continued)



**Fig. 6 Testing for Voltage Drop**

(2) Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit. Refer to the wiring diagrams.

(3) Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.

(4) Isolate the problem area.

(5) Repair the problem.

(6) Verify proper operation. For this step check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

## SERVICE PROCEDURES

### WIRING REPAIR

When replacing or repairing a wire, it is important that the correct gage be used as shown in the wiring diagrams. The wires must also be held securely in place to prevent damage to the insulation.

(1) Disconnect battery negative cable

(2) Remove 1 inch of insulation from each end of the wire.

(3) Place a piece of heat shrink tubing over one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(4) Spread the strands of the wire apart on each part of the exposed wire (example 1). (Fig. 7)

(5) Push the two ends of wire together until the strands of wire are close to the insulation (example 2) (Fig. 7)

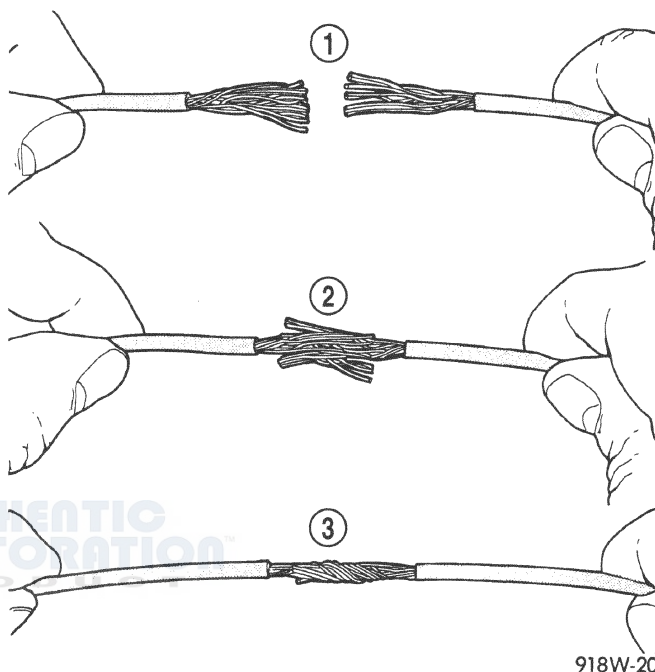
(6) Twist the wires together (example 3) (Fig. 7)

(7) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(8) Center the heat shrink tubing over the joint, and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(9) Secure the wire to the existing ones to prevent chafing or damage to the insulation

(10) Connect battery and test all affected systems.



**Fig. 7 Wire Repair**

- 1 - EXAMPLE 1
- 2 - EXAMPLE 2
- 3 - EXAMPLE 3

### TERMINAL/CONNECTOR REPAIR-MOLEX CONNECTORS

(1) Disconnect battery.

(2) Disconnect the connector from its mating half/component.

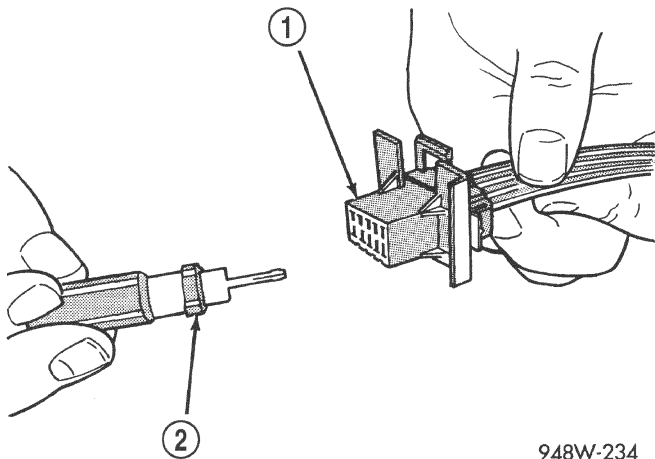
(3) Insert the terminal releasing special tool 6742 into the terminal end of the connector (Fig. 8).

(4) Using special tool 6742 release the locking fingers on the terminal (Fig. 9).

(5) Pull on the wire to remove it from the connector.

(6) Repair or replace the connector or terminal, as necessary.

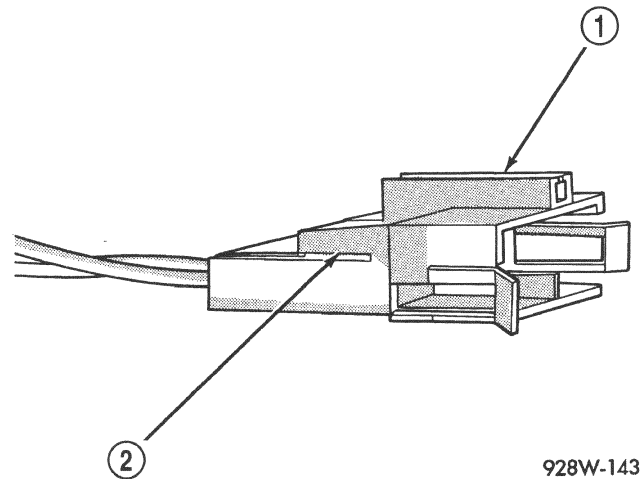
## SERVICE PROCEDURES (Continued)



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**Fig. 8 Molex Connector Repair**

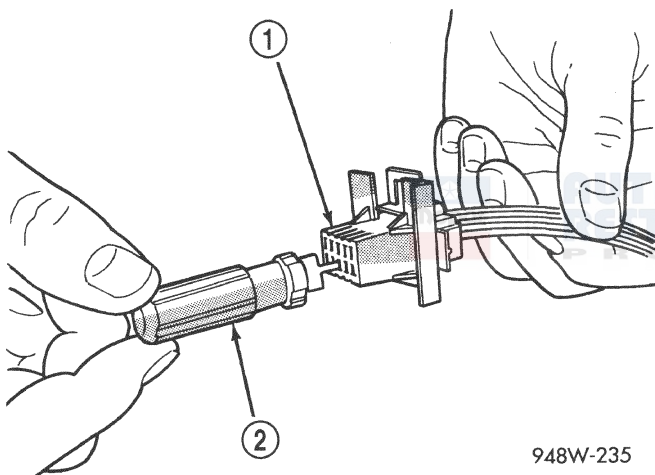
- 1 - CONNECTOR
- 2 - SPECIAL TOOL 6742



928W-143

**Fig. 10 Connector Locking Wedge**

- 1 - CONNECTOR
- 2 - CONNECTOR LOCKING WEDGE TAB



948W-235

**Fig. 9 Using Special Tool 6742**

- 1 - CONNECTOR
- 2 - SPECIAL TOOL 6742

## CONNECTOR REPLACEMENT

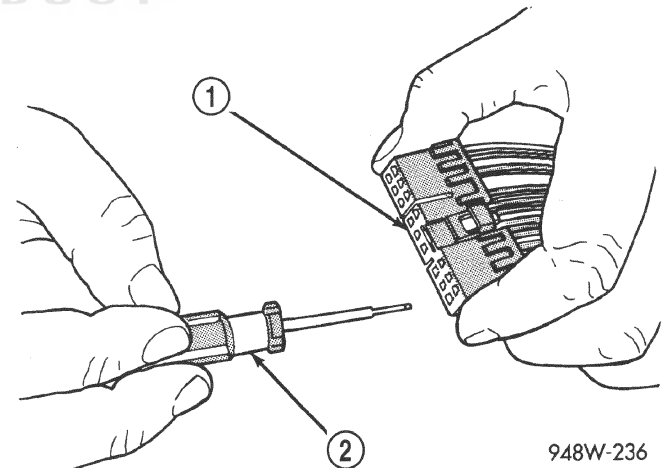
- (1) Disconnect battery.
- (2) Disconnect the connector that is to be repaired from its mating half/component
- (3) Remove the connector locking wedge, if required (Fig. 10)
- (4) Position the connector locking finger away from the terminal using the proper pick from special tool kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 11) (Fig. 12).
- (5) Reset the terminal locking tang, if it has one.
- (6) Insert the removed wire in the same cavity on the repair connector.
- (7) Repeat steps four through six for each wire in the connector, being sure that all wires are inserted

into the proper cavities. For additional connector pin-out identification, refer to the wiring diagrams.

(8) Insert the connector locking wedge into the repaired connector, if required.

(9) Connect connector to its mating half/component.

(10) Connect battery and test all affected systems.



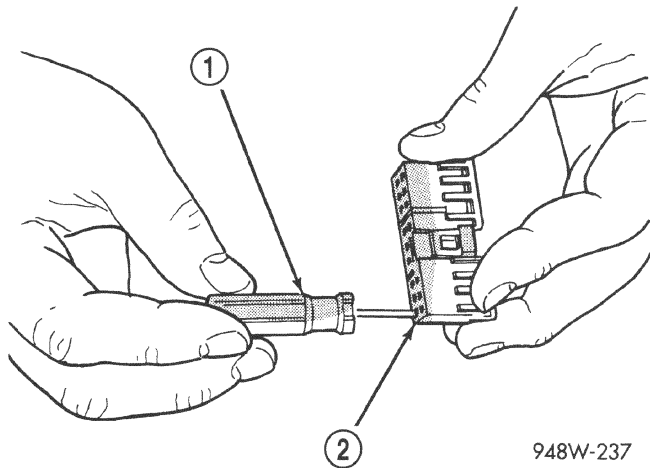
948W-236

**Fig. 11 Terminal Removal**

- 1 - CONNECTOR
- 2 - FROM SPECIAL TOOL KIT 6680

## SERVICE PROCEDURES (Continued)

### CONNECTOR AND TERMINAL REPLACEMENT



**Fig. 12 Terminal Removal Using Special Tool**

- 1 - FROM SPECIAL TOOL KIT 6680
- 2 - CONNECTOR

(1) Disconnect battery.  
 (2) Disconnect the connector (that is to be repaired) from its mating half/component.

(3) Cut off the existing wire connector directly behind the insulator. Remove six inches of tape from the harness.

(4) Stagger cut all wires on the harness side at 1/2 inch intervals (Fig. 13).

(5) Remove 1 inch of insulation from each wire on the harness side.

(6) Stagger cut the matching wires on the repair connector assembly in the opposite order as was done on the harness side of the repair. Allow extra length for soldered connections. Check that the overall length is the same as the original (Fig. 13).

(7) Remove 1 inch of insulation from each wire.

(8) Place a piece of heat shrink tubing over one side of the wire. Be sure the tubing will be long enough to cover and seal the entire repair area.

(9) Spread the strands of the wire apart on each part of the exposed wires.

(10) Push the two ends of wire together until the strands of wire are close to the insulation.

(11) Twist the wires together.

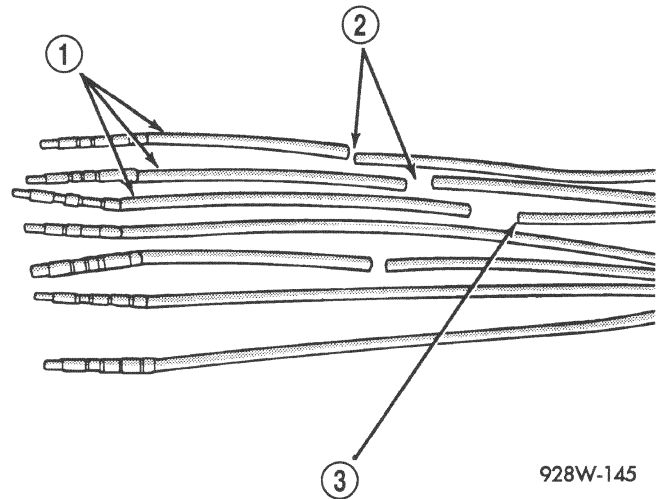
(12) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(13) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing

(14) Repeat steps 8 through 13 for each wire.

(15) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(16) Re-connect the repaired connector.



**Fig. 13 Stagger Cutting Wires**

- 1 - REPAIR SIDE WIRES
- 2 - STAGER CUTS
- 3 - HARNESS WIRES

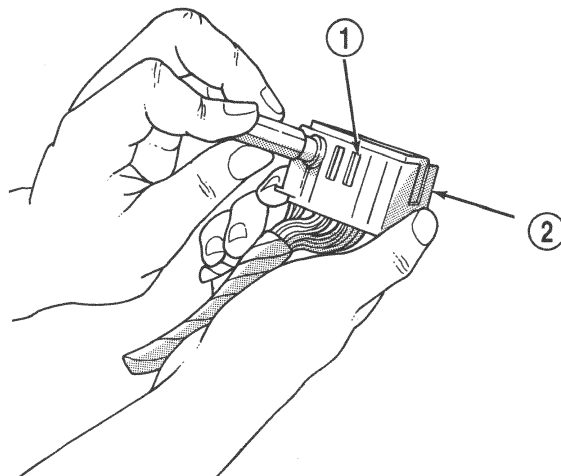
(17) Connect the battery, and test all affected systems.

### TERMINAL/CONNECTOR REPAIR- AUGAT CONNECTORS

(1) Disconnect battery.

(2) Disconnect the connector from its mating half/component.

(3) Push down on the yellow connector locking tab to release the terminals (Fig. 14).



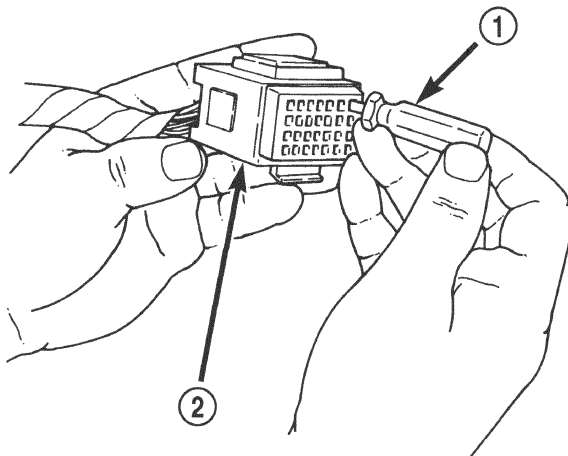
**Fig. 14 Augat Connector Repair**

- 1 - LOCKING TAB
- 2 - CONNECTOR

(4) Using special tool 6932, push the terminal to remove it from the connector (Fig. 15).



## SERVICE PROCEDURES (Continued)



803f5845

**Fig. 15 Using Special Tool 6932**

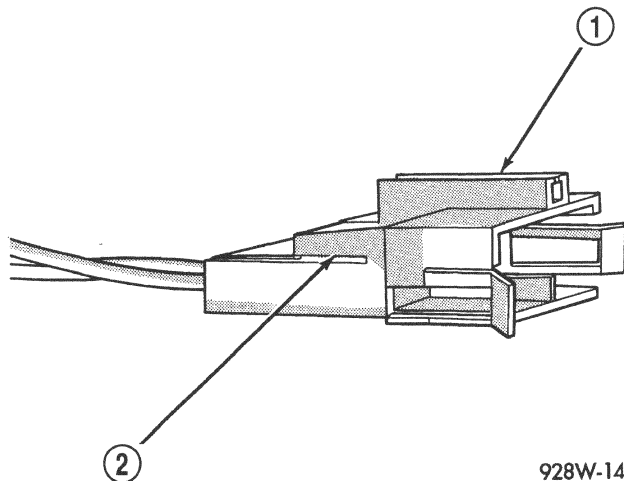
- 1 - SPECIAL TOOL 6932
- 2 - CONNECTOR

(5) Repair or replace the connector or terminal as necessary.

(6) When re-assembling the connector, the locking wedge must be placed in the locked position to prevent terminal push out.

### TERMINAL REPLACEMENT

- (1) Disconnect battery.
- (2) Disconnect the connector being repaired from its mating half. Remove connector locking wedge, if required (Fig. 16).
- (3) Remove connector locking wedge, if required (Fig. 16).



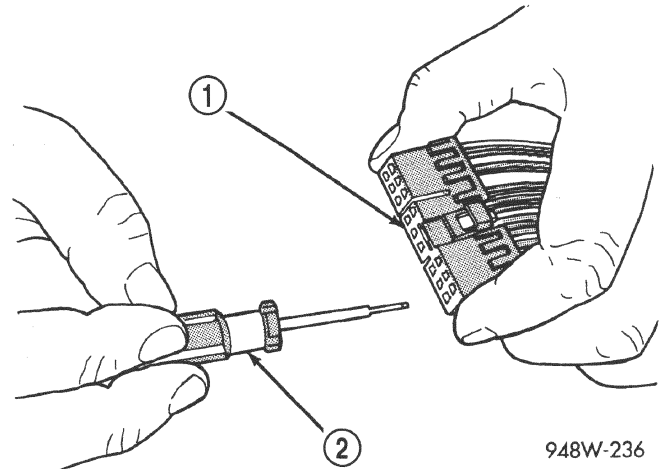
928W-143

**Fig. 16 Connector Locking Wedge Tab (Typical)**

- 1 - CONNECTOR
- 2 - CONNECTOR LOCKING WEDGE TAB

(4) Position the connector locking finger away from the terminal using the proper pick from special tool

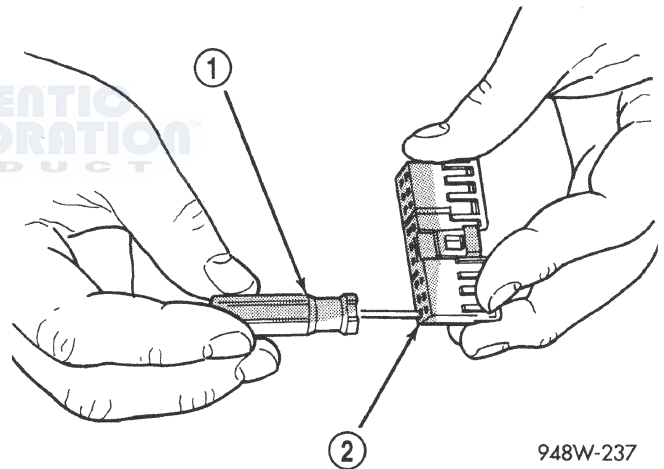
kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 17) (Fig. 18).



948W-236

**Fig. 17 Terminal Removal**

- 1 - CONNECTOR
- 2 - FROM SPECIAL TOOL KIT 6680



948W-237

**Fig. 18 Terminal Removal Using Special Tool**

- 1 - FROM SPECIAL TOOL KIT 6680
- 2 - CONNECTOR

(5) Cut the wire 6 inches from the back of the connector.

(6) Remove 1 inch of insulation from the wire on the harness side.

(7) Select a wire from the terminal repair assembly that best matches the color wire being repaired.

(8) Cut the repair wire to the proper length and remove 1 inch of insulation.

(9) Place a piece of heat shrink tubing over one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(10) Spread the strands of the wire apart on each part of the exposed wires.

## SERVICE PROCEDURES (Continued)

(11) Push the two ends of wire together until the strands of wire are close to the insulation.

(12) Twist the wires together.

(13) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(14) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(15) Insert the repaired wire into the connector.

(16) Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.

(17) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

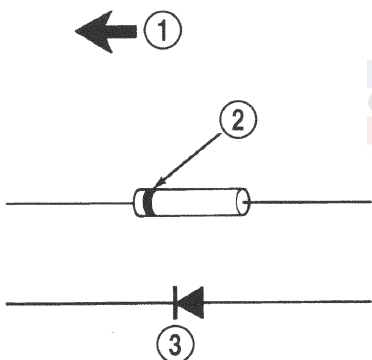
(18) Connect battery, and test all affected systems.

## DIODE REPLACEMENT

(1) Disconnect the battery.

(2) Locate the diode in the harness, and remove the protective covering.

(3) Remove the diode from the harness, pay attention to the current flow direction (Fig. 19).



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**Fig. 19 Diode Identification**

- 1 - CURRENT FLOW
- 2 - BAND AROUND DIODE INDICATES CURRENT FLOW
- 3 - DIODE AS SHOWN IN THE DIAGRAMS

(4) Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.

(5) Install the new diode in the harness, making sure current flow is correct. If necessary refer to the appropriate wiring diagram for current flow.

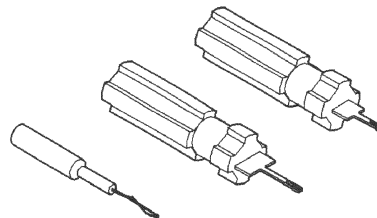
(6) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(7) Tape the diode to the harness using electrical tape making, sure the diode is completely sealed from the elements.

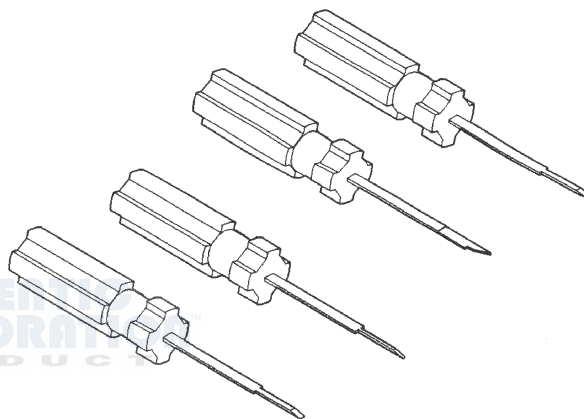
(8) Re-connect the battery, and test affected systems.

## SPECIAL TOOLS

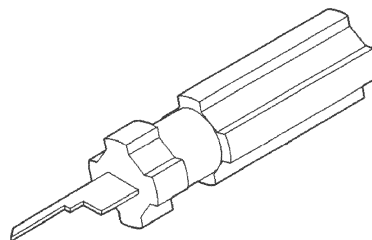
### WIRING/TERMINAL



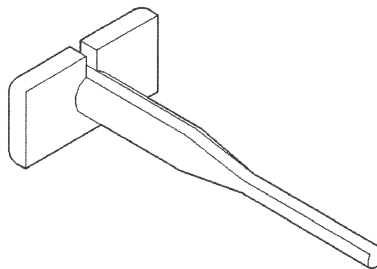
**Probing Tool Package 6807**



**Terminal Pick 6680**



**Terminal Removing Tool 6932**



**Terminal Removing Tool 6934**

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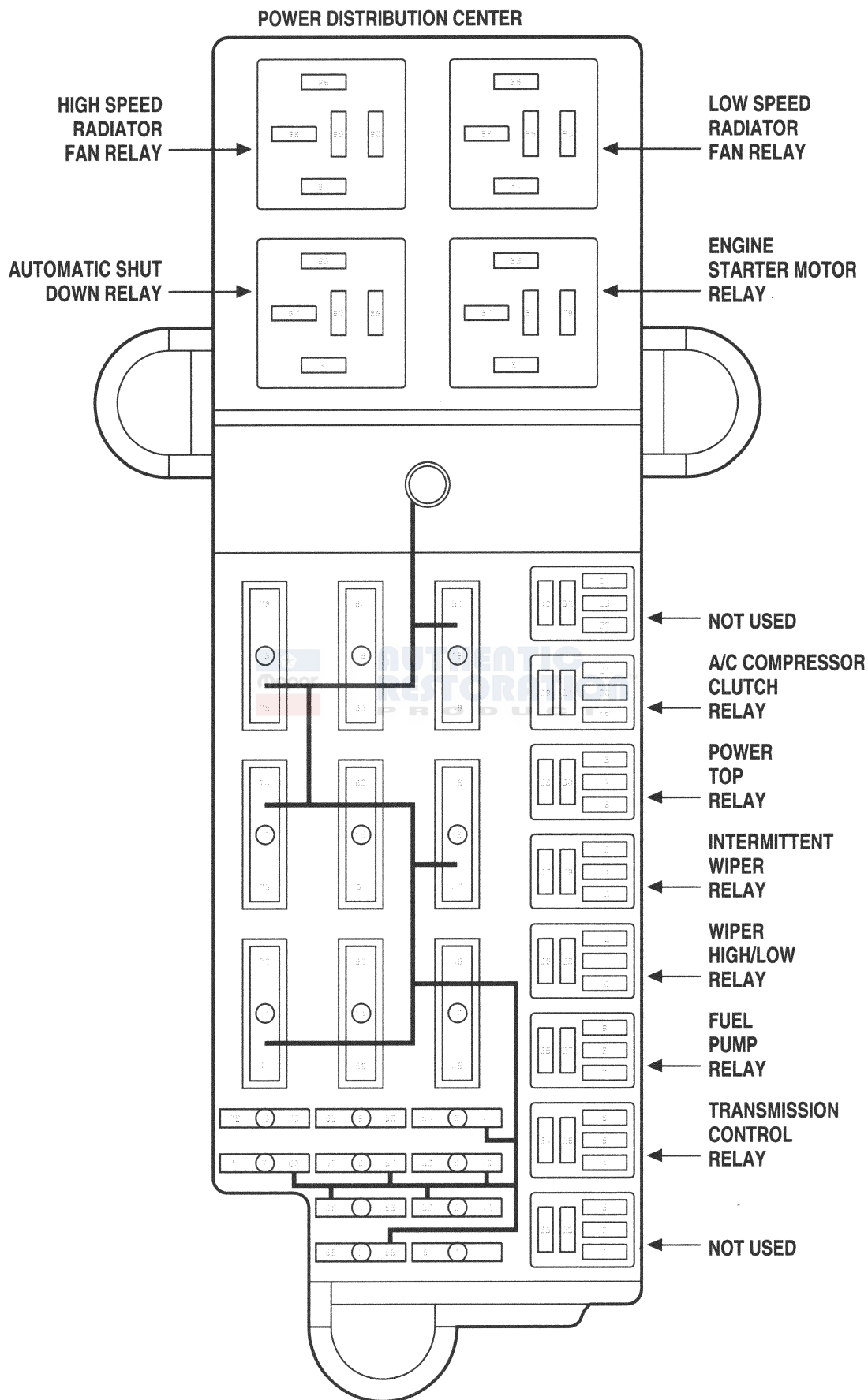


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Combination Flasher	8W-10-9	Fuse 17 (PDC)	8W-10-7, 16
Controller Anti-Lock Brake	8W-10-8, 13, 14	Fuse 18 (PDC)	8W-10-7, 17
Daytime Running Lamp Module	8W-10-15	Fuse 19 (PDC)	8W-10-7, 17
Engine Starter Motor	8W-10-10	G301	8W-10-10
Engine Starter Motor Relay	8W-10-10, 11	Headlamp Delay Relay	8W-10-15
Fuel Pump Module	8W-10-10, 12	Headlamp Switch	8W-10-15
Fuel Pump Relay	8W-10-10, 13	High Speed Radiator Fan Relay	8W-10-12, 17
Fuse 1 (JB)	8W-10-16	Ignition Switch	8W-10-10, 11, 16
Fuse 2 (PDC)	8W-10-7, 8	Instrument Cluster	8W-10-10, 12
Fuse 3 (PDC)	8W-10-7, 8	Intermittent Wiper Relay	8W-10-17
Fuse 4 (JB)	8W-10-16	Junction Block	8W-10-9, 10, 11, 14, 15, 16
Fuse 4 (PDC)	8W-10-7, 9	Low Speed Radiator Fan Relay	8W-10-12, 17
Fuse 5 (JB)	8W-10-9	Oxygen Sensor 1/2 Downstream	8W-10-8
Fuse 5 (PDC)	8W-10-7, 9	Power Distribution Center	8W-10-2, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17
Fuse 6 (JB)	8W-10-14	Power Top Up/Down Relays	8W-10-16
Fuse 6 (PDC)	8W-10-7, 9	Powertrain Control Module	8W-10-9, 13
Fuse 7 (JB)	8W-10-14	Radiator Fan Motor Assembly	8W-10-17
Fuse 7 (PDC)	8W-10-7, 10	Rear Window Defogger	8W-10-14
Fuse 8 (JB)	8W-10-14	Rear Window Defogger Relay	8W-10-14
Fuse 8 (PDC)	8W-10-7, 10	Seat Belt Control Module	8W-10-13
Fuse 9 (JB)	8W-10-15	Sentry Key Immobilizer Module	8W-10-9, 12
Fuse 9 (PDC)	8W-10-7, 11, 12	Transmission Control Module	8W-10-8, 11
Fuse 1 (PDC)	8W-10-8, 9	Transmission Control Relay	8W-10-8
Fuse 10 (JB)	8W-10-15	Transmission Solenoid And Pressure Switch	
Fuse 10 (PDC)	8W-10-7, 11, 13	Assembly	8W-10-8
Fuse 11 (JB)	8W-10-11	Windshield Wiper Motor	8W-10-17
Fuse 11 (PDC)	8W-10-7, 13	Wiper High/Low Relay	8W-10-17
Fuse 12 (JB)	8W-10-15		
Fuse 12 (PDC)	8W-10-7, 14		





## FUSES

FUSE NO.	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	10A	F142 18OR/DG	A142 18DG/OR
2	20A	A20 12RD/DB	A0 4RD
3	20A	A24 16PK/YL	A0 4RD
		A24 16PK/YL	
4	20A	A7 12RD/BK	A0 4RD
5	20A	A14 16RD/TN	A0 4RD
6	20A	A15 16PK	A0 4RD
7	10A	A51 20RD/LB	A0 4RD
8	20A	A1 16RD	A0 4RD
9	10A	F18 20LG/BK	A21 16DB
10	10A	F12 18DB/WT	A21 16DB
			A21 16DB
11	20A	A45 18BR	A0 4RD
12	40A	A4 12BK/PK	A0 4RD
13	40A	A10 12RD/DG	A0 4RD
14	40A	A13 12PK/WT	A0 4RD
15	40A	A3 12RD/WT	A0 4RD
16	40A	A2 12PK/BK	A0 4RD
17	40A	A25 12DB	A0 4RD
18	40A	A5 12RD/GY	A0 4RD
19	40A	A16 12RD/LG	A0 4RD

## RELAYS

CAV	CIRCUIT	FUNCTION
19	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
20	-	-
21	C28 20DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
31	C3 14DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
39	A16 12RD/LG	FUSED B(+)

A/C  
COMPRESSOR  
CLUTCH  
RELAY

**AUTOMATIC  
SHUT DOWN  
RELAY**

CAV	CIRCUIT	FUNCTION
89	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
91	A14 16RD/TN	FUSED B(+)
92	-	-
93	K51 20DB/VT	AUTOMATIC SHUT DOWN RELAY CONTROL
97	A14 16RD/TN	FUSED B(+)

**ENGINE  
STARTER  
MOTOR  
RELAY**

CAV	CIRCUIT	FUNCTION
79	T40 14BR	ENGINE STARTER RELAY OUTPUT
81	A41 16YL/OR	IGNITION SWITCH OUTPUT (START)
	A41 16YL	IGNITION SWITCH OUTPUT (START)
82	-	-
83	K90 18TN/RD	SMART START RELAY CONTROL
87	A1 16RD	FUSED B(+)

**FUEL  
PUMP  
RELAY**

CAV	CIRCUIT	FUNCTION
7	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
8	-	-
9	K31 20BR/LG	FUEL PUMP RELAY CONTROL
27	A141 14DG/WT	FUEL PUMP RELAY OUTPUT
35	A1 16RD	FUSED B(+)

**HIGH SPEED  
RADIATOR  
FAN  
RELAY**

CAV	CIRCUIT	FUNCTION
90	C25 12YL/RD	HIGH SPEED RADIATOR FAN RELAY OUTPUT
94	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
95	-	-
96	C27 20DB/PK	HIGH SPEED RADIATOR FAN RELAY CONTROL
98	A16 12RD/LG	FUSED B(+)

**INTERMITTENT  
WIPER  
RELAY**

CAV	CIRCUIT	FUNCTION
13	F13 20DB/GY	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
	F13 18DB/GY	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
14	Z1 16BK	GROUND
15	V14 20PK/VT	INTERMITTENT WIPER RELAY CONTROL
29	A5 12RD/GY	FUSED B(+)
37	V5 14DG/VT	WIPER RELAY COMMON

**LOW SPEED  
RADIATOR  
FAN RELAY**

CAV	CIRCUIT	FUNCTION
80	C23 12DG/LG	LOW SPEED RADIATOR FAN RELAY OUTPUT
84	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
85	-	-
86	C24 20DB/TN	LOW SPEED RADIATOR FAN RELAY CONTROL
88	A16 12RD/LG	FUSED B(+)



**POWER TOP  
RELAY**

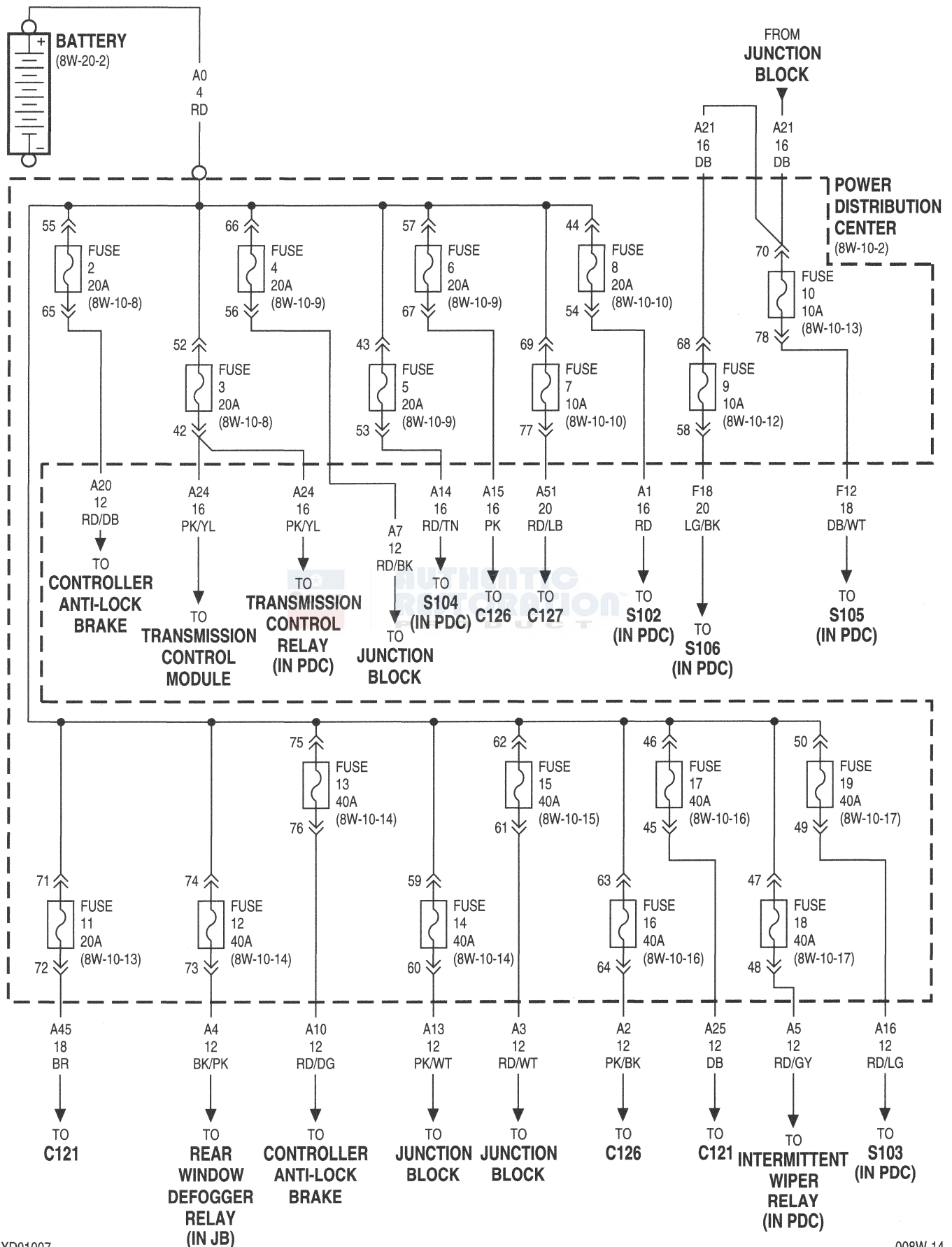
CAV	CIRCUIT	FUNCTION
16	F20 18WT/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
17	-	-
18	G43 20WT/RD	POWER TOP INHIBIT RELAY CONTROL
30	F20 18WT/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
38	P118 20WT/BK	POWER TOP INHIBIT RELAY OUTPUT

**TRANSMISSION  
CONTROL  
RELAY**

CAV	CIRCUIT	FUNCTION
4	T15 20LG/YL	TRANSMISSION CONTROL RELAY CONTROL
5		
6	Z13 20BK/RD	GROUND
26	T16 16RD/BR	TRANSMISSION CONTROL RELAY OUTPUT
34	A24 16PK/YL	FUSED B(+)

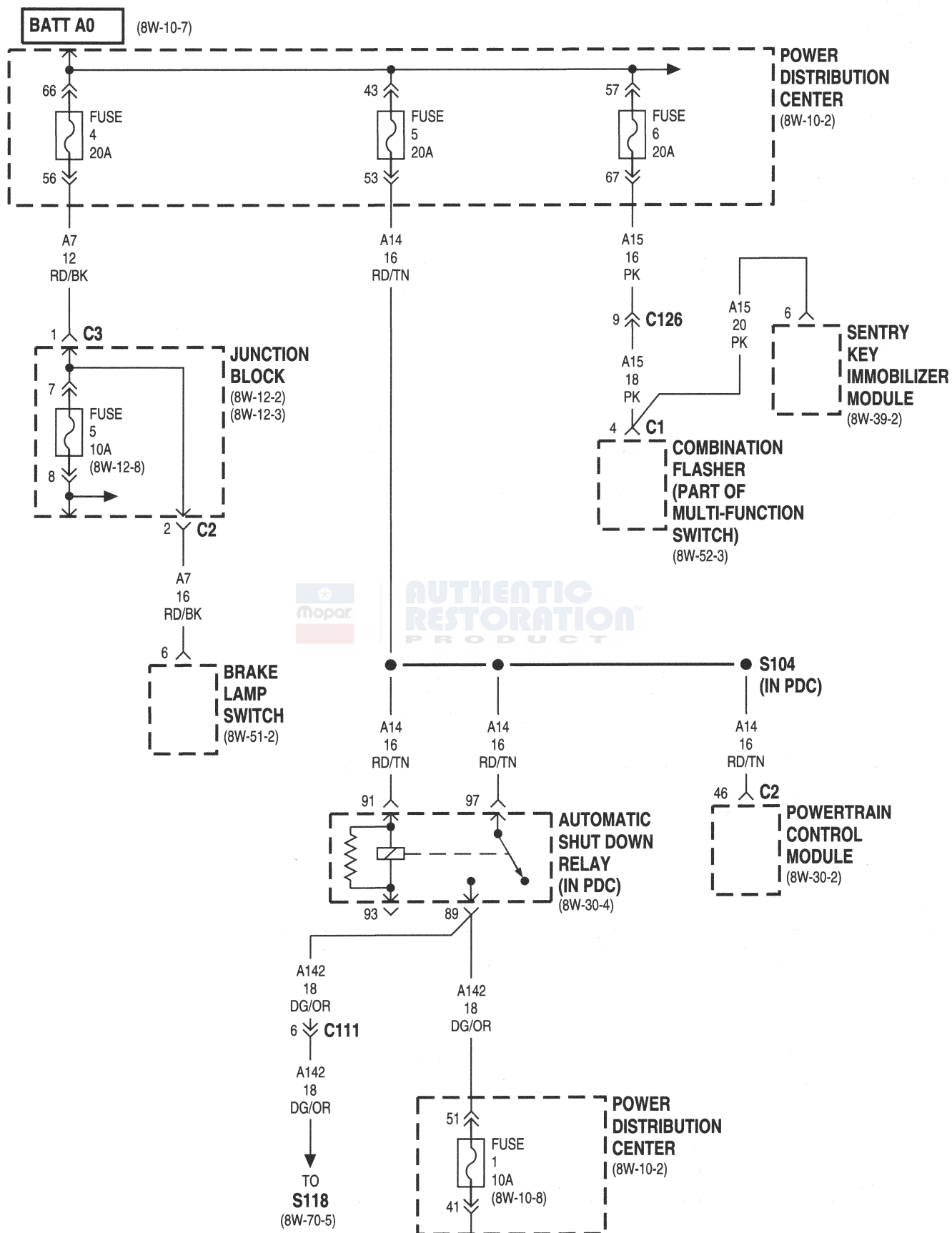
**WIPER  
HIGH/LOW  
RELAY**

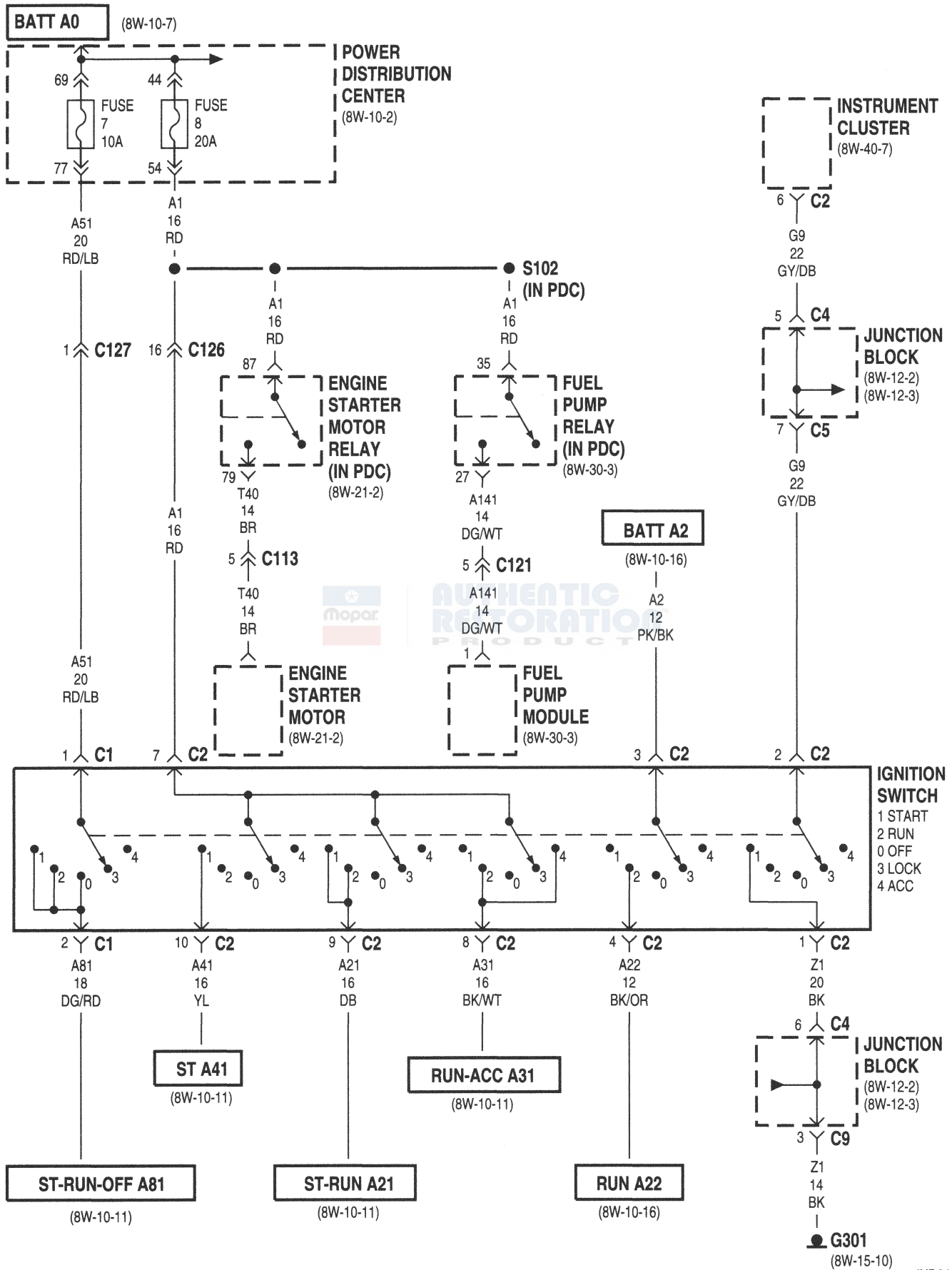
CAV	CIRCUIT	FUNCTION
10	F13 18DB/GY	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
11	V3 14BR/OR	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
12	V16 20VT/PK	WIPER HIGH/LOW RELAY CONTROL
28	V4 14RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
36	V5 14DG/VT	WIPER RELAY COMMON













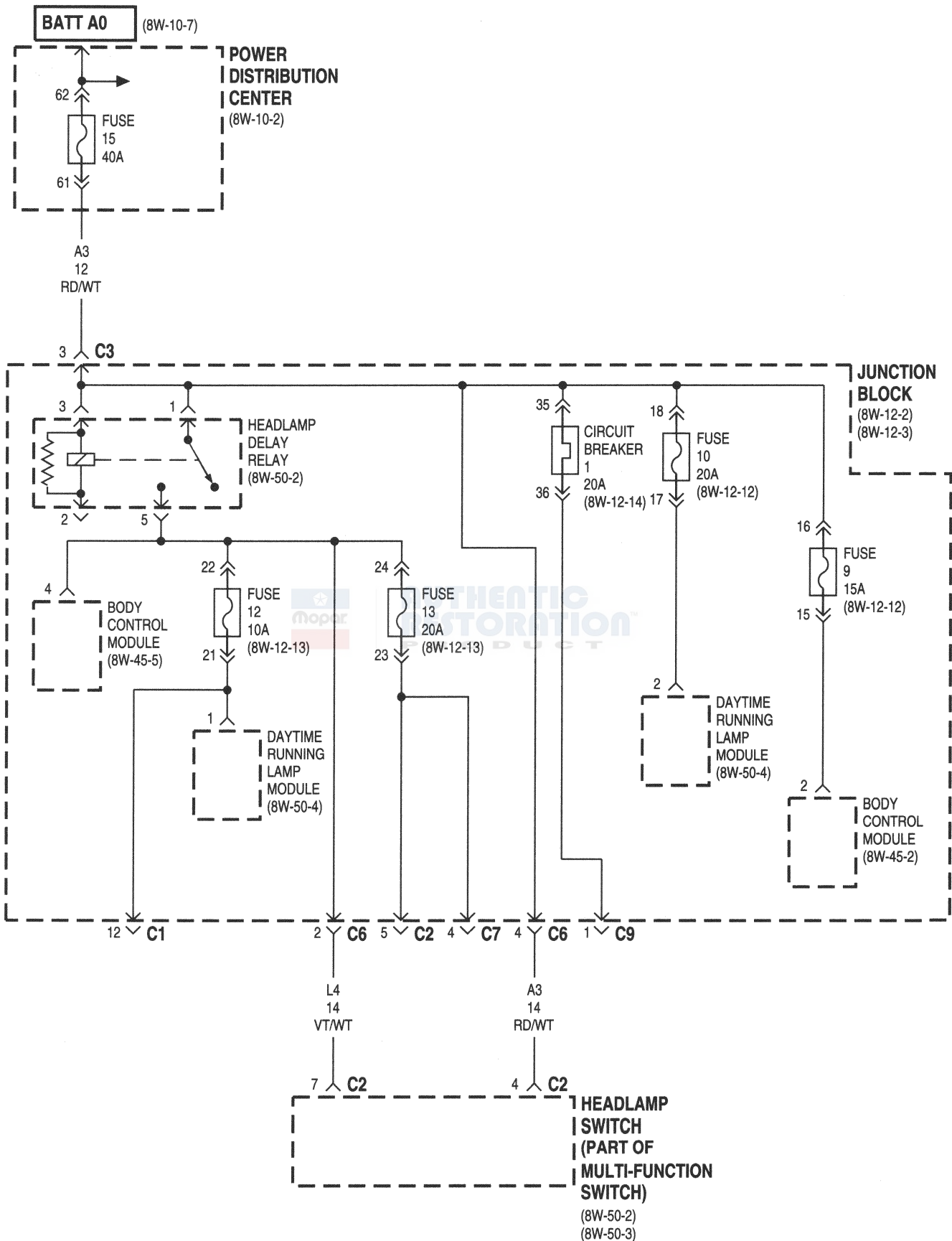


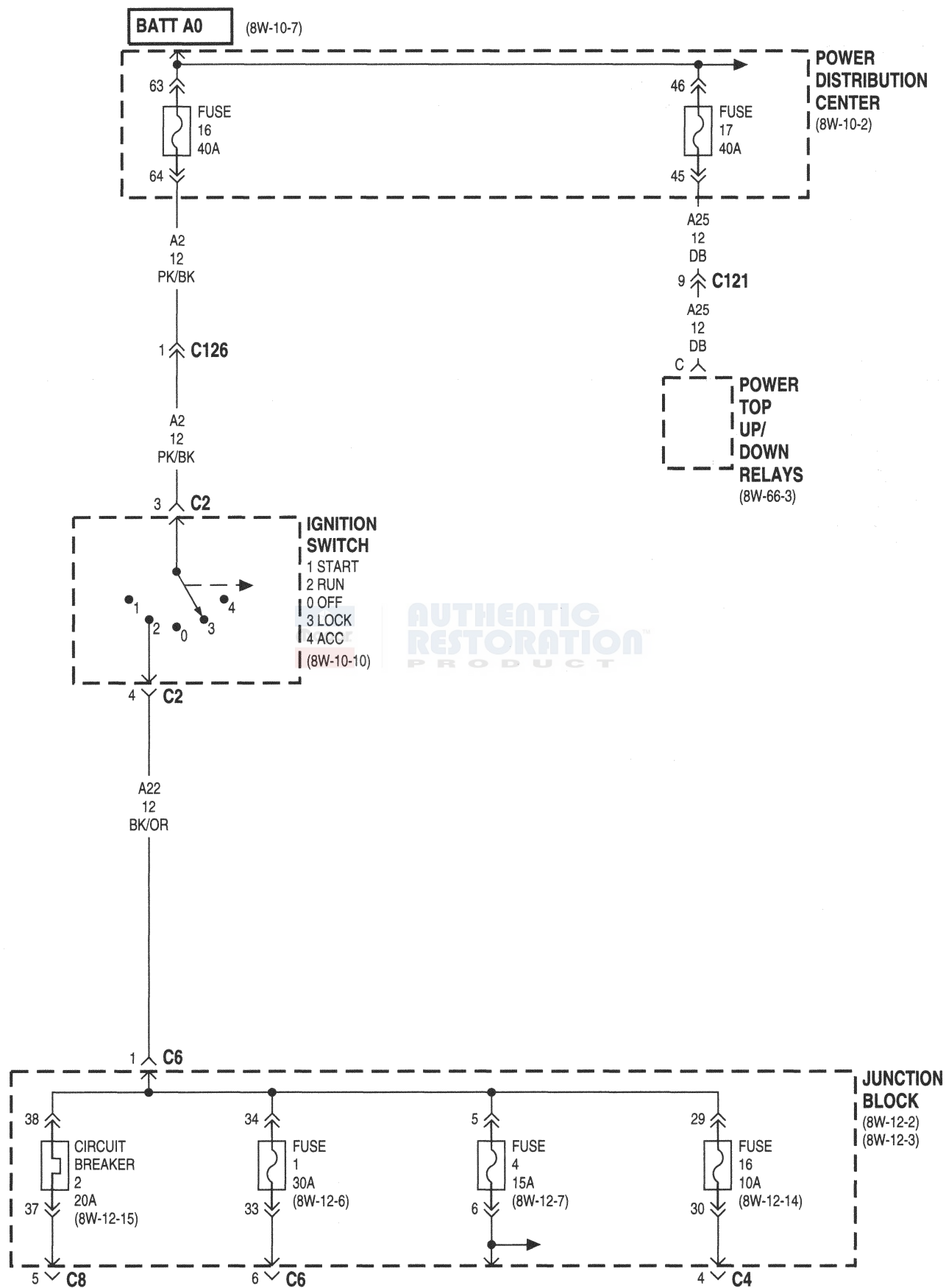


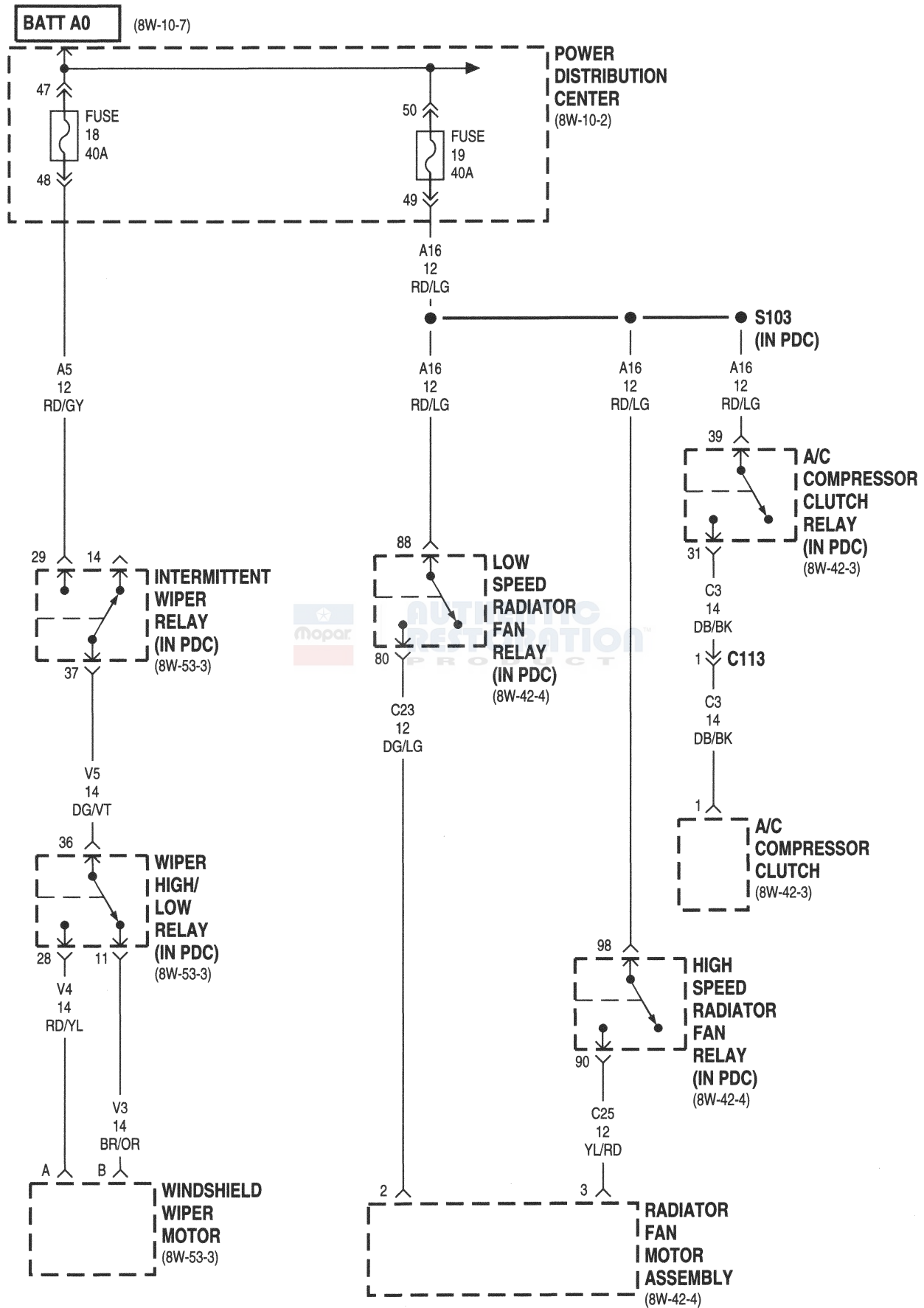








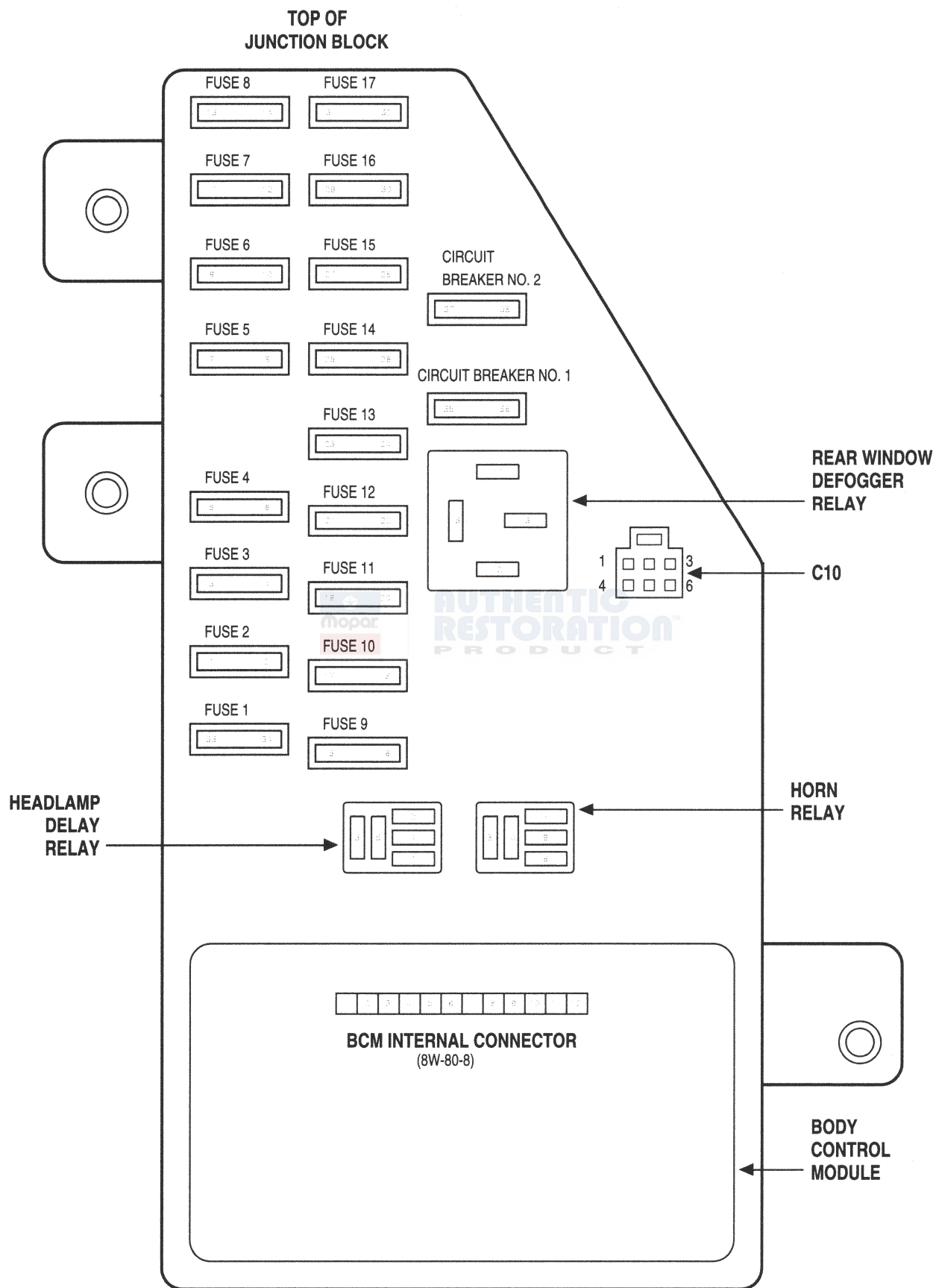


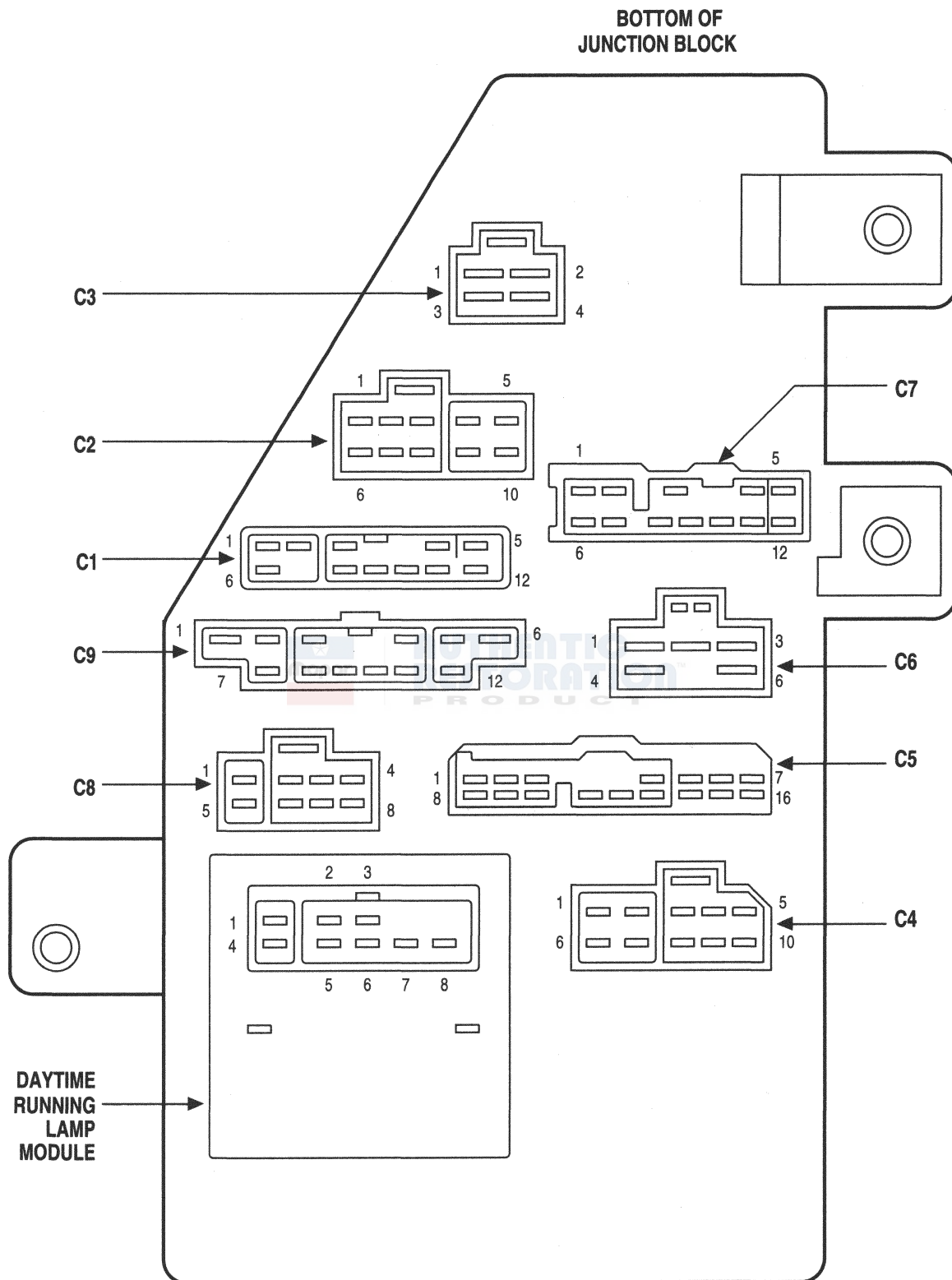




## 8W-12 JUNCTION BLOCK

Component	Page	Component	Page
A/C- Heater Control	8W-12-10	Left Door Window Motor Relay	8W-12-15
Airbag Control Module	8W-12-14	Left Fog Lamp	8W-12-18
Automatic Day/Night Mirror	8W-12-7, 8, 16	Left Front Power Window Motor	8W-12-15
Autostick Switch	8W-12-12, 16	Left Headlamp	8W-12-6, 13
Body Control Module	8W-12-6, 8, 9, 11, 12, 13, 16, 17	Left Park/Turn Signal Lamp	8W-12-17, 20
Brake Fluid Level Switch	8W-12-18	Left Power Door Lock Switch	8W-12-7, 9
Brake Lamp Switch	8W-12-8, 19	Left Power Mirror	8W-12-10
Center High Mounted Stop Lamp	8W-12-19	Left Rear Park/Turn Signal Lamp	8W-12-17, 20
Cigar Lighter/Power Outlet	8W-12-11	Left Side Marker Lamp	8W-12-17
Circuit Breaker 1 (JB)	8W-12-14	Left Tail/Stop Lamp	8W-12-17, 19
Circuit Breaker 2 (JB)	8W-12-15	Left Visor/Vanity Lamp	8W-12-8
Clockspring No. 1	8W-12-11	License Lamp	8W-12-17
Combination Flasher	8W-12-13	Low Note Horn	8W-12-11
Controller Anti-Lock Brake	8W-12-19	Master Power Window Switch	8W-12-15
Data Link Connector	8W-12-8, 16	Overhead Map Lamp	8W-12-8, 16
Daytime Running Lamp Module	8W-12-6, 7, 12, 13, 16, 18	Park Brake Switch	8W-12-18
Decklid Release Relay	8W-12-14	Power Amplifier	8W-12-8, 16
Decklid Solenoid	8W-12-14	Power Antenna	8W-12-8
Fog Lamp Switch	8W-12-13, 18	Power Distribution Center	8W-12-14
Fuse 1 (JB)	8W-12-6	Power Mirror Switch	8W-12-7
Fuse 2 (JB)	8W-12-6	Power Seat Switch	8W-12-14
Fuse 3 (JB)	8W-12-6	Power Top Relay	8W-12-7
Fuse 4 (JB)	8W-12-7	Radio	8W-12-8, 13, 17
Fuse 5 (JB)	8W-12-8	Rear Floor Courtesy Lamp	8W-12-9
Fuse 6 (JB)	8W-12-10	Rear Window Defogger	8W-12-10
Fuse 7 (JB)	8W-12-10	Rear Window Defogger Relay	8W-12-10, 13
Fuse 8 (JB)	8W-12-11	Resistor Block	8W-12-6
Fuse 9 (JB)	8W-12-12	Right Door Arm/Disarm Switch	8W-12-9
Fuse 10 (JB)	8W-12-12	Right Door Courtesy Lamp	8W-12-9
Fuse 11 (JB)	8W-12-12	Right Door Window Motor Relay	8W-12-15
Fuse 12 (JB)	8W-12-13	Right Fog Lamp	8W-12-18
Fuse 13 (JB)	8W-12-13	Right Headlamp	8W-12-6, 13
Fuse 14 (JB)	8W-12-13	Right Park/Turn Signal Lamp	8W-12-17, 20
Fuse 15 (JB)	8W-12-13	Right Power Door Lock Switch	8W-12-7, 9
Fuse 16 (JB)	8W-12-14	Right Power Mirror	8W-12-10
Fuse 17 (JB)	8W-12-14	Right Power Window Switch	8W-12-15
G301	8W-12-16	Right Rear Park/Turn Signal Lamp	8W-12-17, 20
Glove Box Lamp	8W-12-8	Right Side Marker Lamp	8W-12-17
Headlamp Delay Relay	8W-12-13	Right Tail/Stop Lamp	8W-12-17, 19
Headlamp Switch	8W-12-6, 10, 13, 16, 17	Right Visor/Vanity Lamp	8W-12-8
High Note Horn	8W-12-11	Seat Belt Control Module	8W-12-13
Horn Relay	8W-12-11	Sentry Key Immobilizer Module	8W-12-16
Horn Switches	8W-12-11	Traction Control Switch	8W-12-16
Ignition Switch	8W-12-16, 18	Transmission Control Module	8W-12-12
Illuminated Entry Relay	8W-12-9, 16	Transmission Range Sensor	8W-12-7
Instrument Cluster	8W-12-10, 12, 16, 18, 20	Traveler	8W-12-8
Intermittent Wiper Relay	8W-12-13	Trunk Lamp	8W-12-8
Junction Block	8W-12-2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20	Turn Signal/Hazard Warning Switch	8W-12-20
Key-In Switch	8W-12-16	Universal Garage Door Opener	8W-12-8
Left Door Arm/Disarm Switch	8W-12-9	Window Timer Module	8W-12-15
Left Door Courtesy Lamp	8W-12-9	Wiper High/Low Relay	8W-12-13







## FUSES

FUSE	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	30A	C1 12 DG	A22 12BK/OR
2	20A	INTERNAL	L3 14RD/OR
3	20A	L33 18LG/BR	L3 14RD/OR
4	15A	INTERNAL	A22 12BK/OR
5	10A	INTERNAL	A7 16RD/BK
6	10A	INTERNAL	INTERNAL
7	20A	INTERNAL	A13 12PK/WT
8	20A	INTERNAL	A13 12PK/WT
9	15A	INTERNAL	A3 12RD/WT
10	20A	INTERNAL	A3 12RD/WT
11	10A	INTERNAL	A81 18DG/RD
12	10A	INTERNAL	L4 14VT/WT
13	20A	INTERNAL	L4 14VT/WT
14	10A	X12 18RD/WT	A31 16BK/WT
15	10A	INTERNAL	A31 16BK/WT
16	10A	F23 18WT	A22 12BK/OR
17	10A	F14 18LG/YL	A21 16DB

## CIRCUIT BREAKERS

C.B.	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	20A	F35 16RD	A3 12RD/WT
2	20A	F21 14TN	A22 12BK/OR

DAYTIME  
RUNNING  
LAMP  
MODULE

CAVITY	CIRCUIT	FUNCTION
1	INTERNAL	FUSED LEFT LOW BEAM OUTPUT
2	INTERNAL	FUSED B(+)
3	-	-
4	INTERNAL	FUSED RIGHT HIGH BEAM OUTPUT
5	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN)
6	INTERNAL	RED BRAKE WARNING INDICATOR DRIVER
7	-	-
8	INTERNAL	GROUND

## RELAYS

HEADLAMP  
DELAY  
RELAY

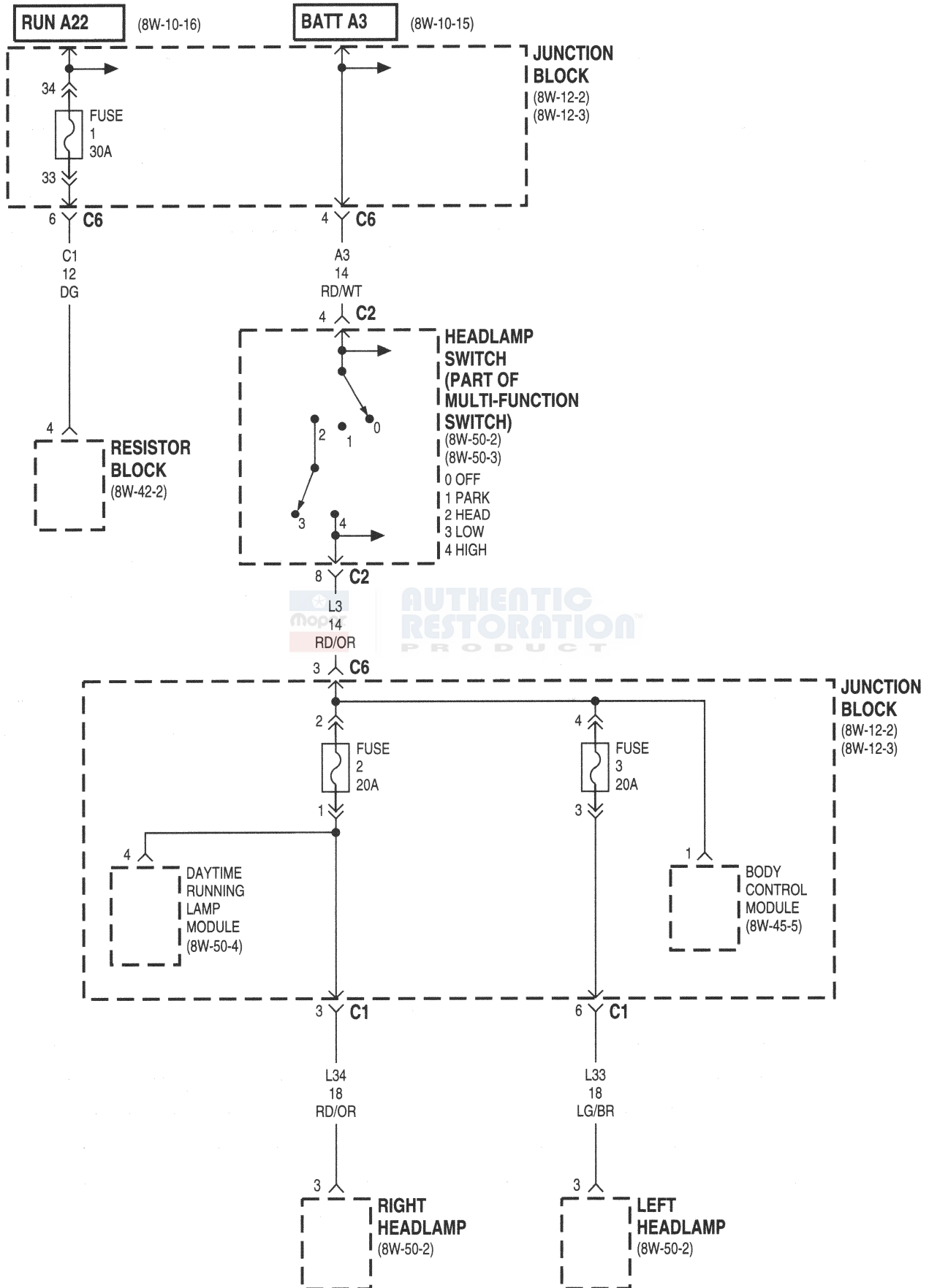
CAV	CIRCUIT	FUNCTION
1	A3 12RD/WT	FUSED B(+)
2	INTERNAL	HEADLAMP DELAY RELAY CONTROL
3	A3 12RD/WT	FUSED B(+)
4	-	-
5	INTERNAL	HEADLAMP DELAY RELAY OUTPUT

HORN  
RELAY

CAV	CIRCUIT	FUNCTION
6	INTERNAL	FUSED B(+)
7	INTERNAL	HORN RELAY CONTROL
8	INTERNAL	FUSED B(+)
9	-	-
10	X2 18DG/PK	HORN RELAY OUTPUT

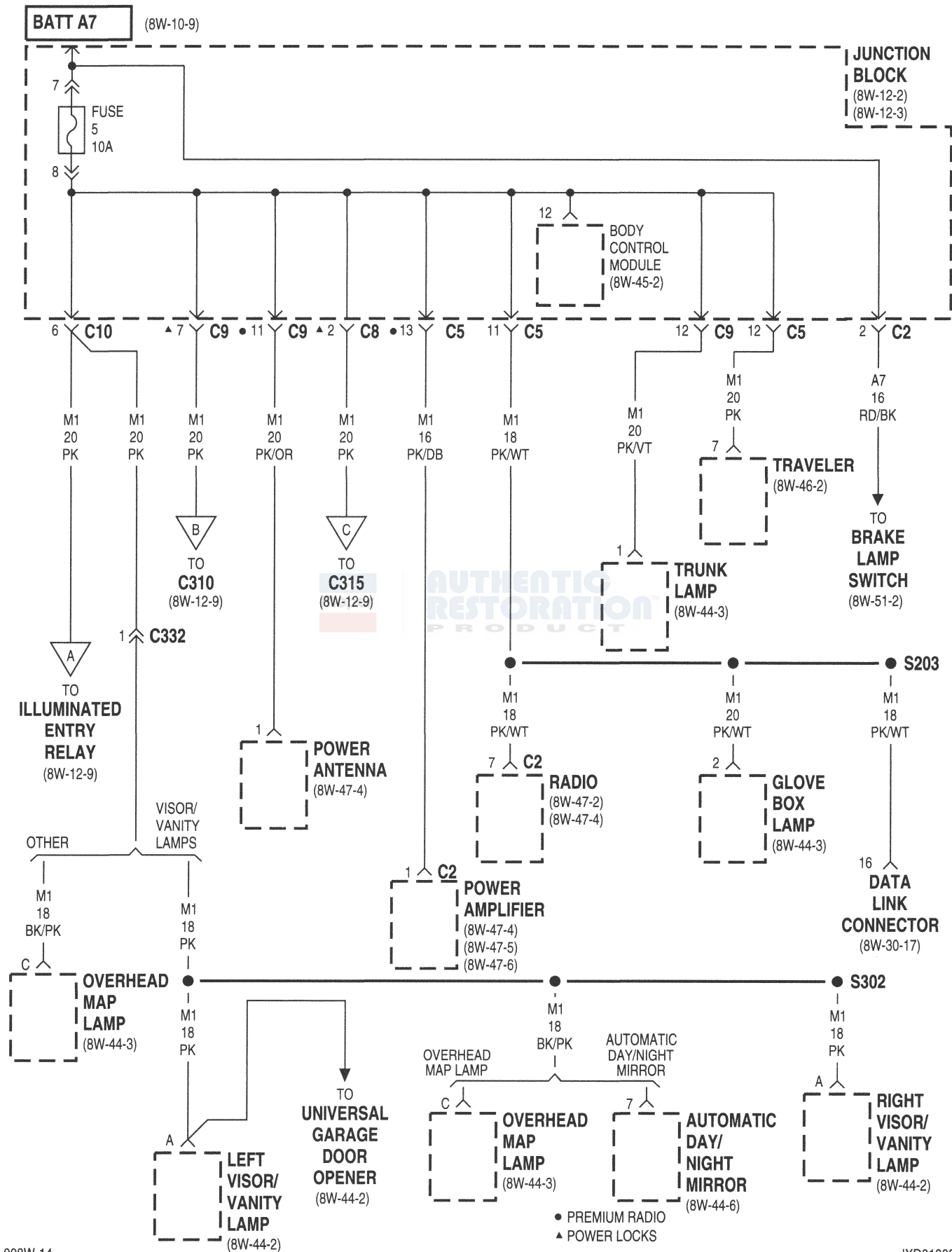
REAR  
WINDOW  
DEFOGGER  
RELAY

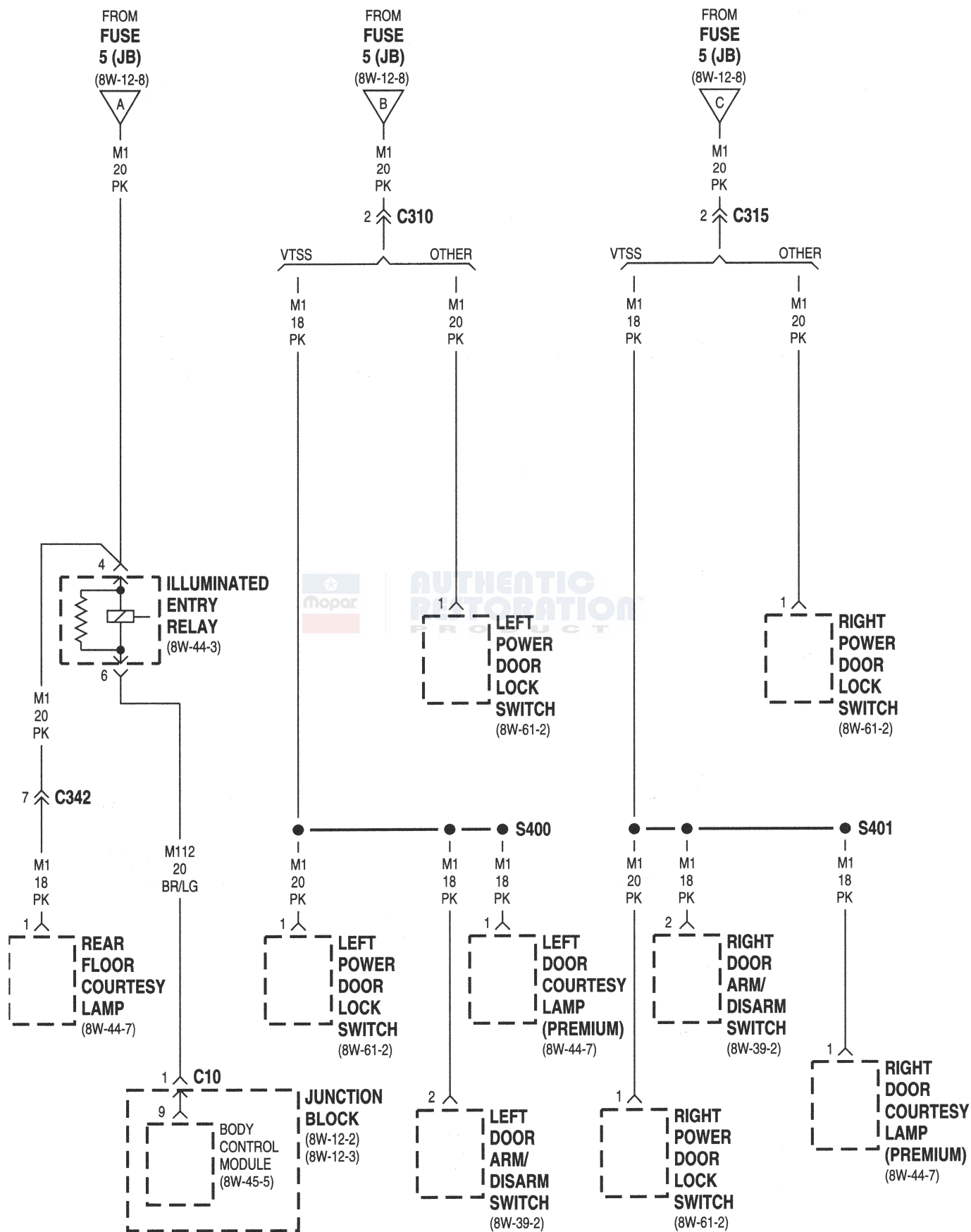
CAV	CIRCUIT	FUNCTION
11	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
12	INTERNAL	REAR WINDOW DEFOGGER RELAY CONTROL
13	A4 12BK/PK	FUSED B(+)
14	-	-
15	INTERNAL	REAR WINDOW DEFOGGER RELAY OUTPUT



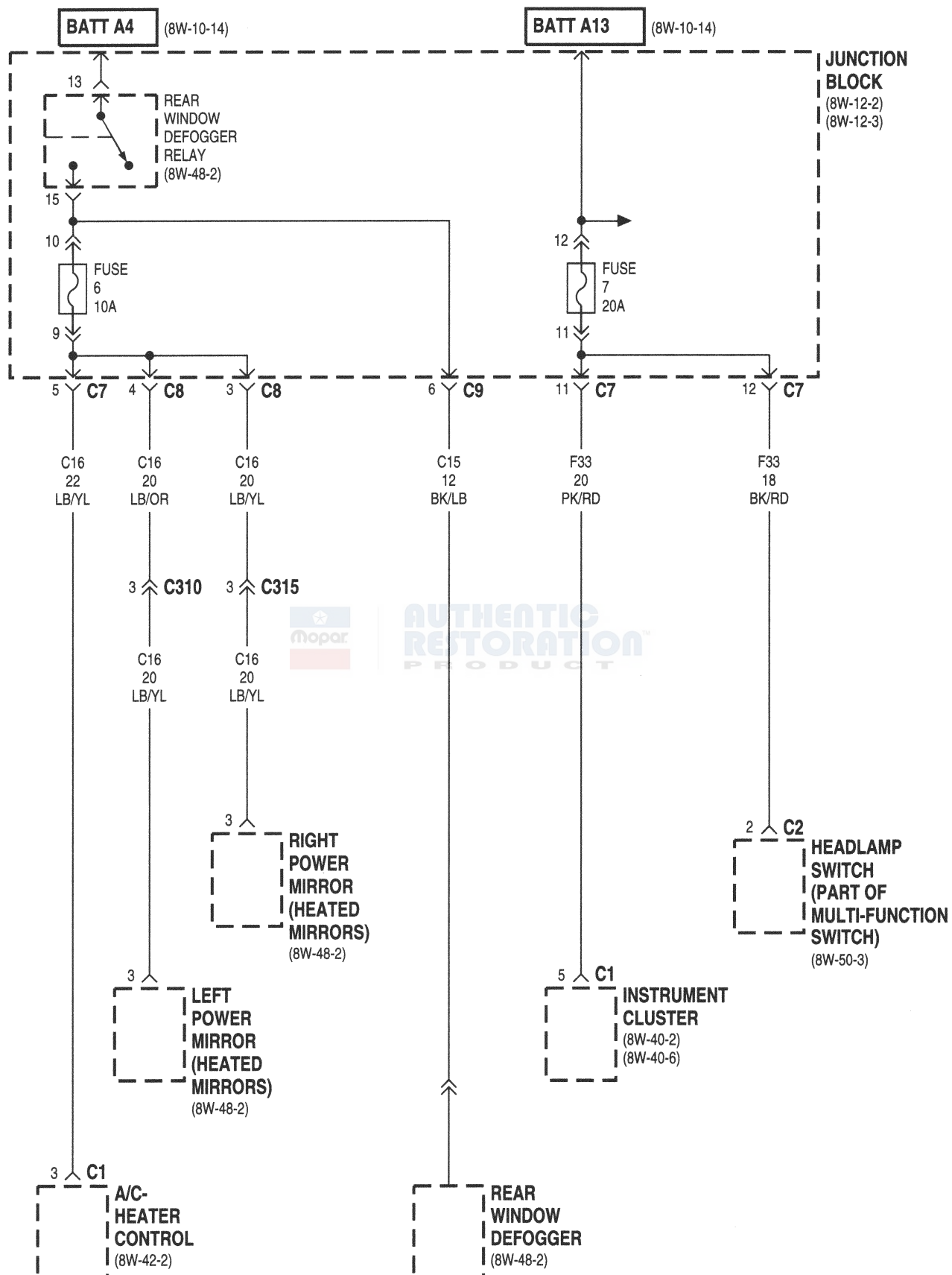




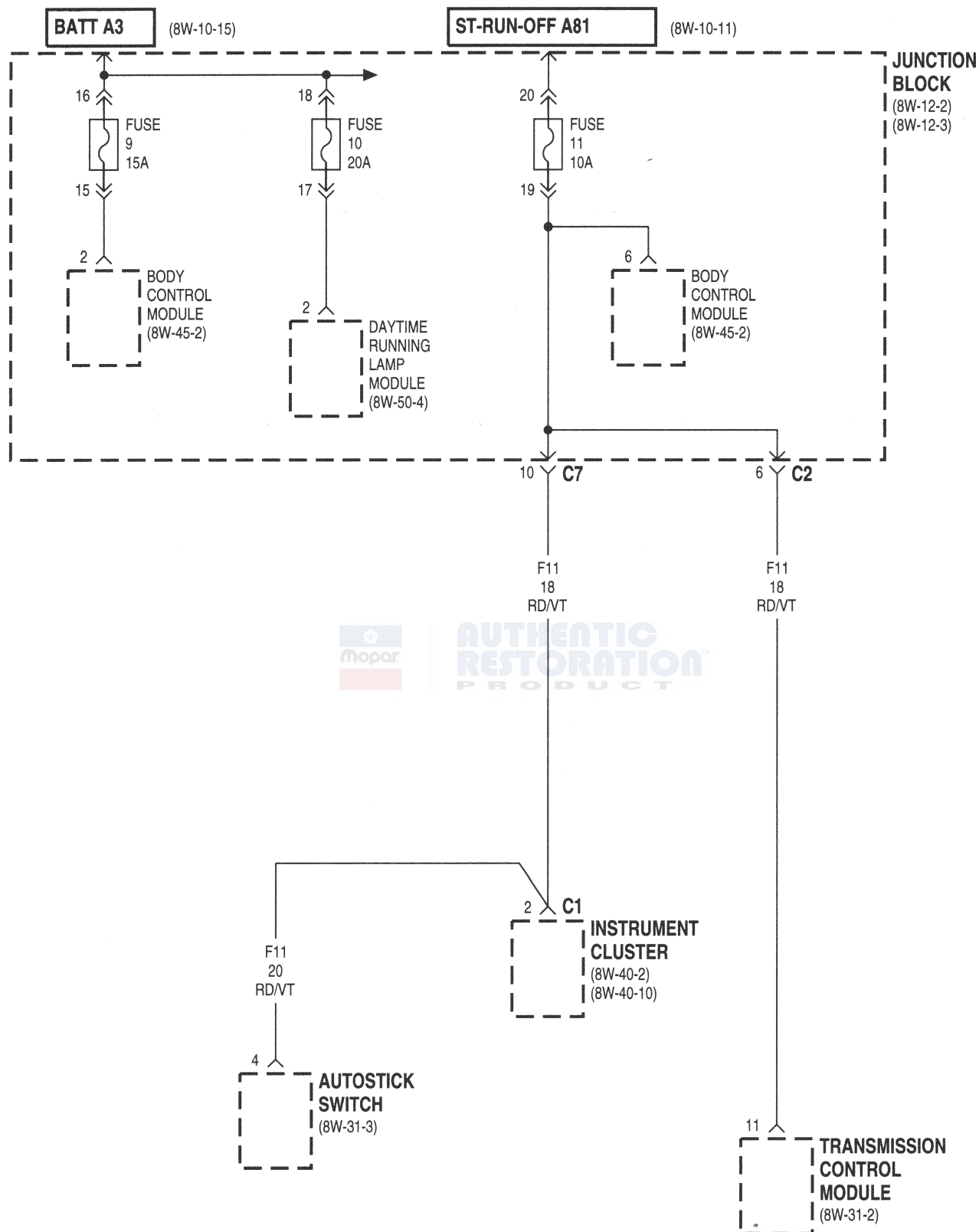




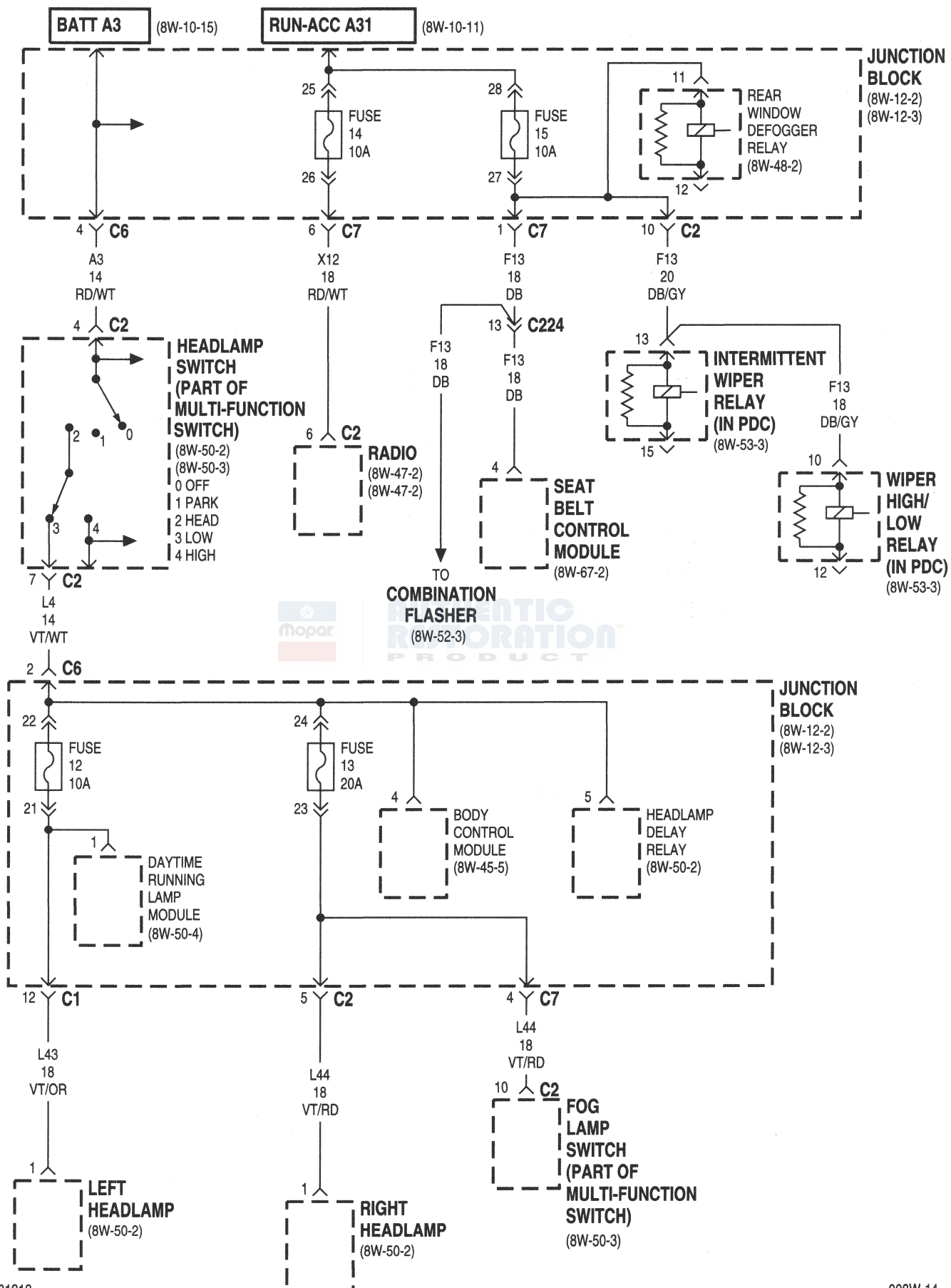


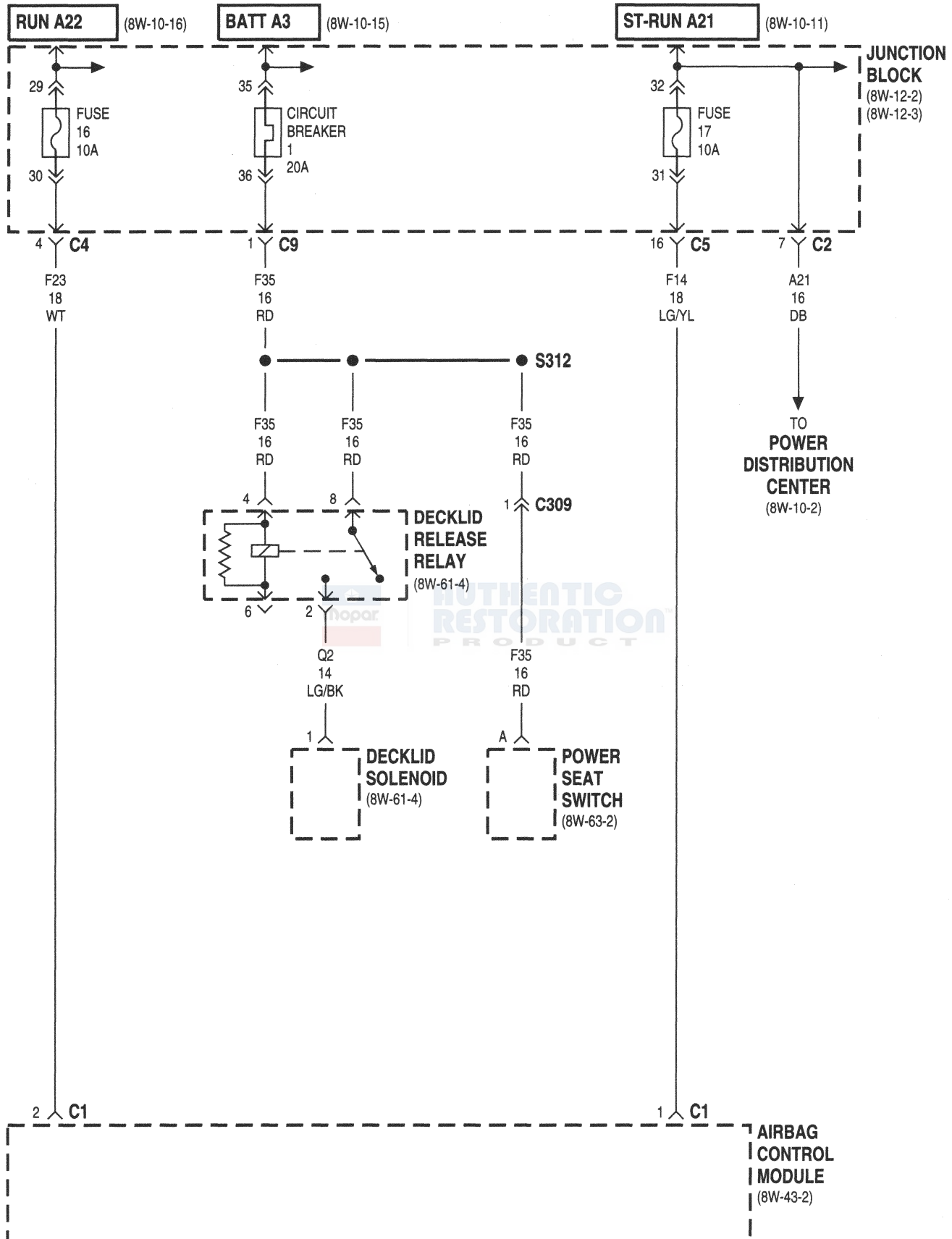






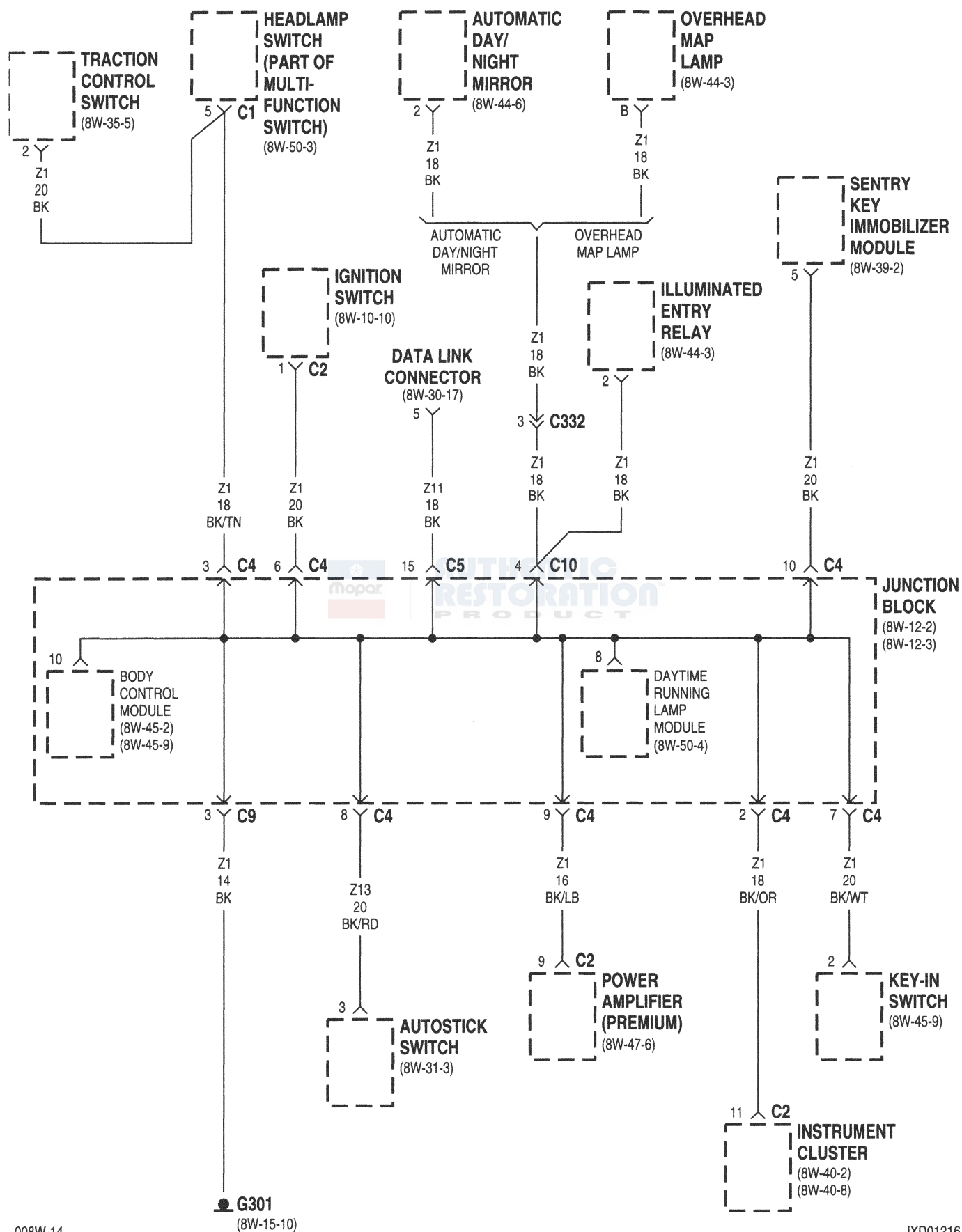


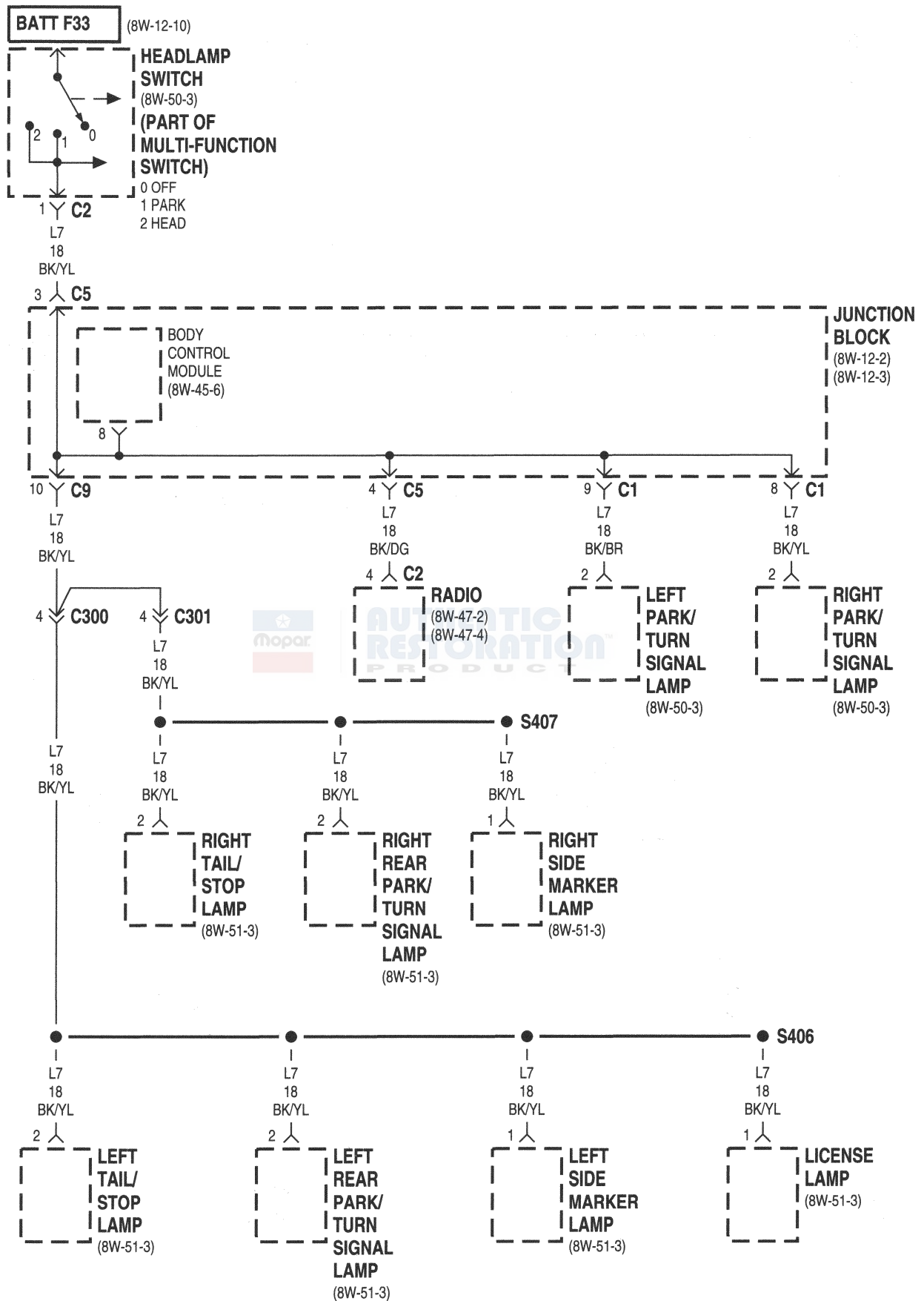


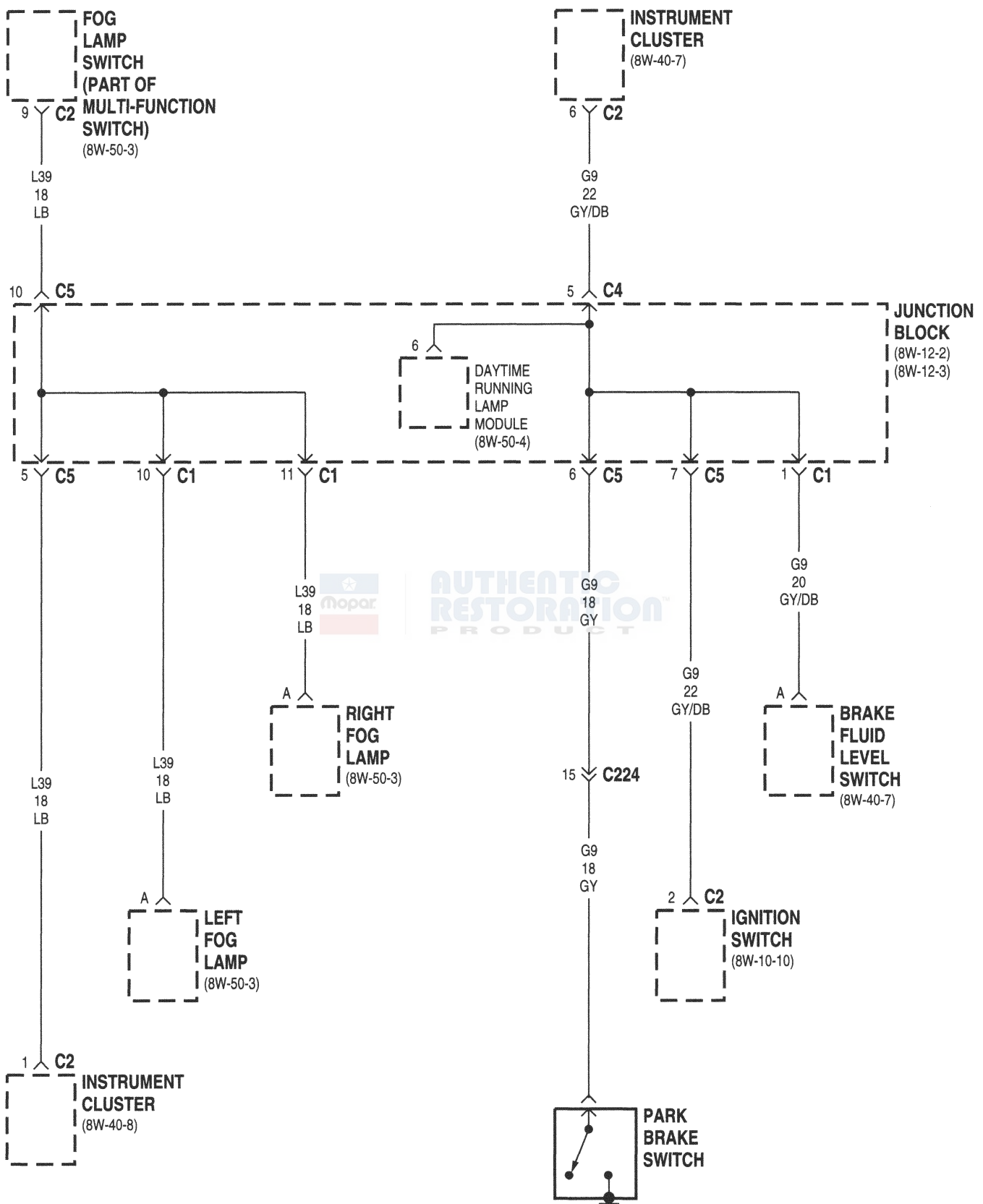




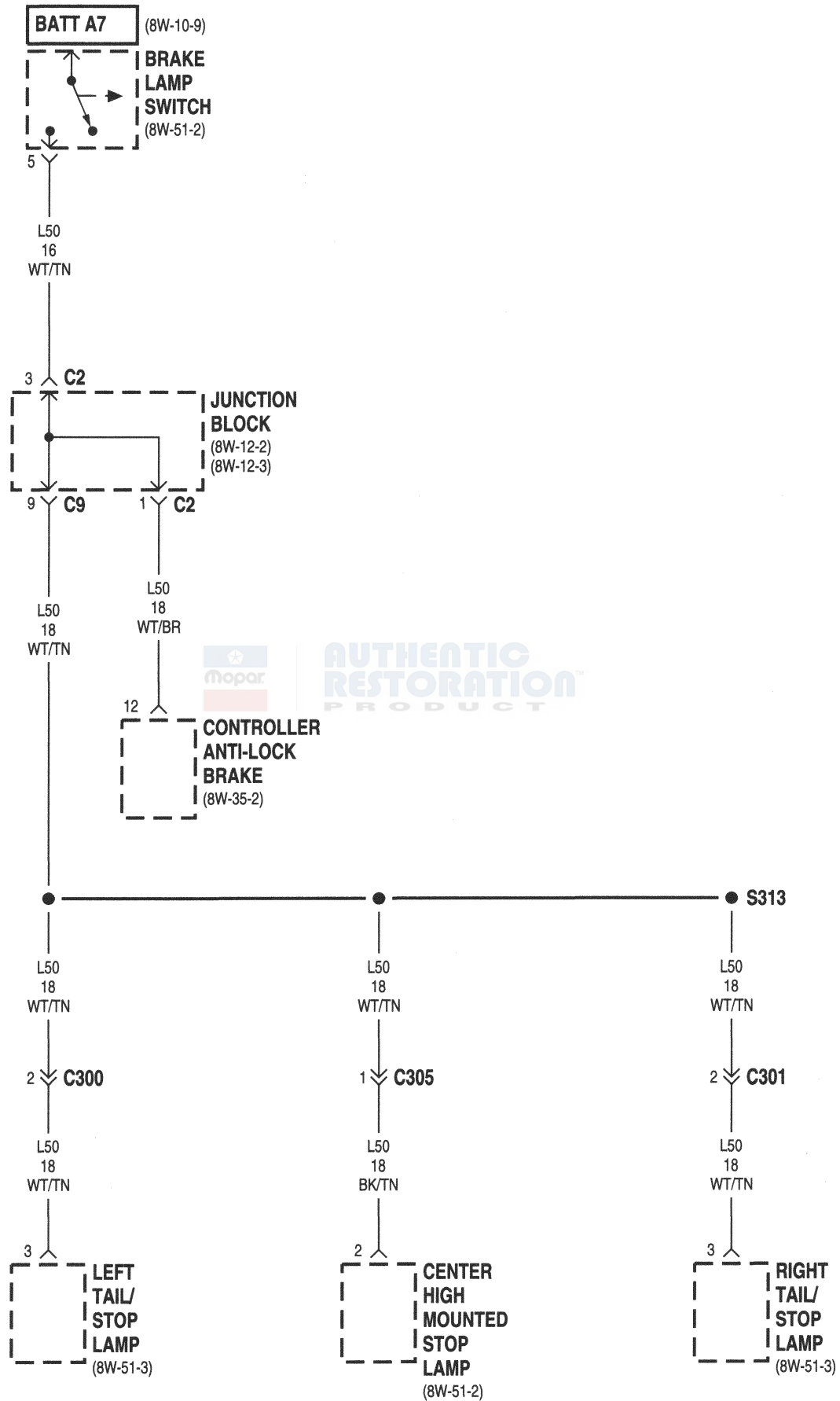


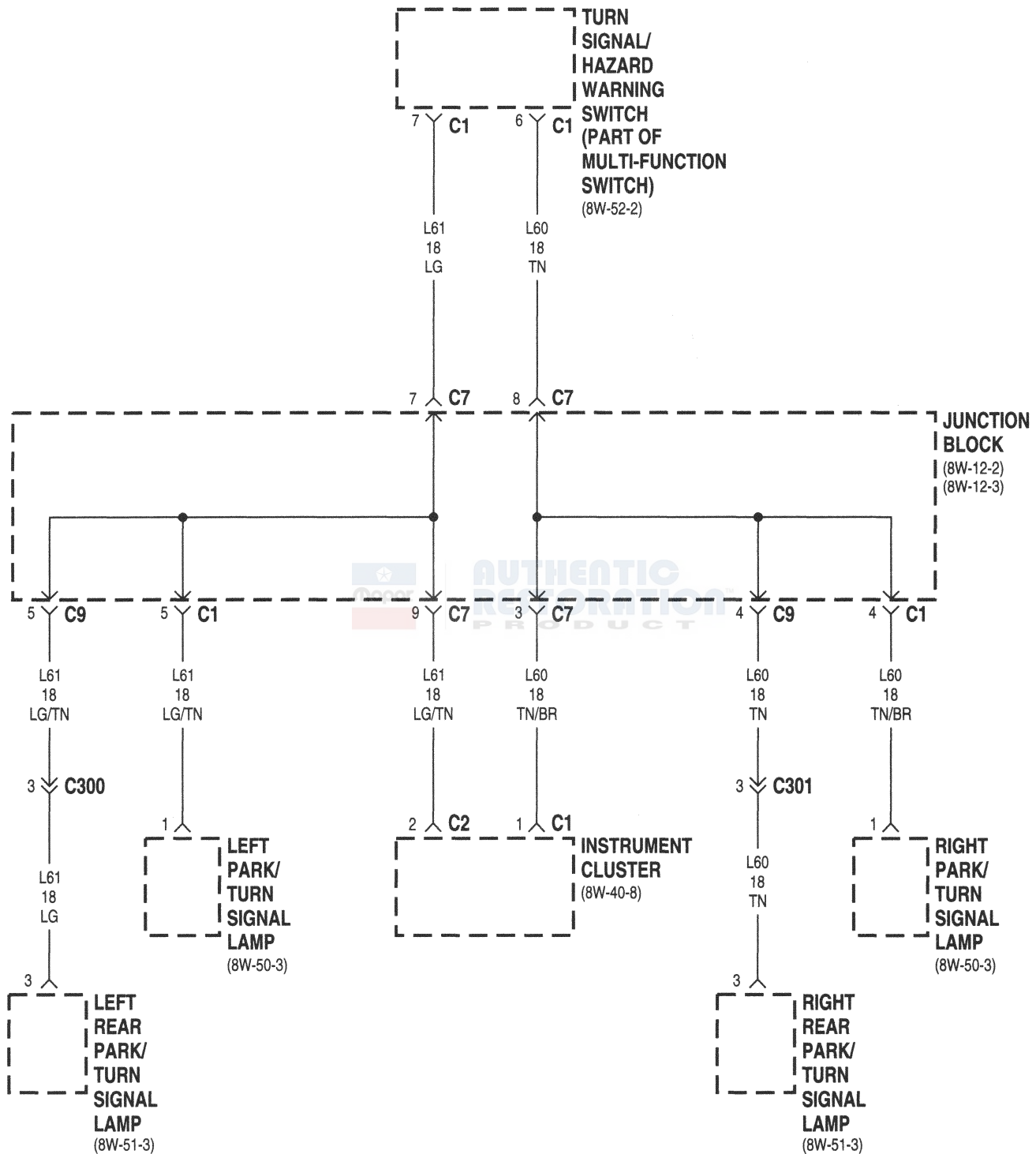








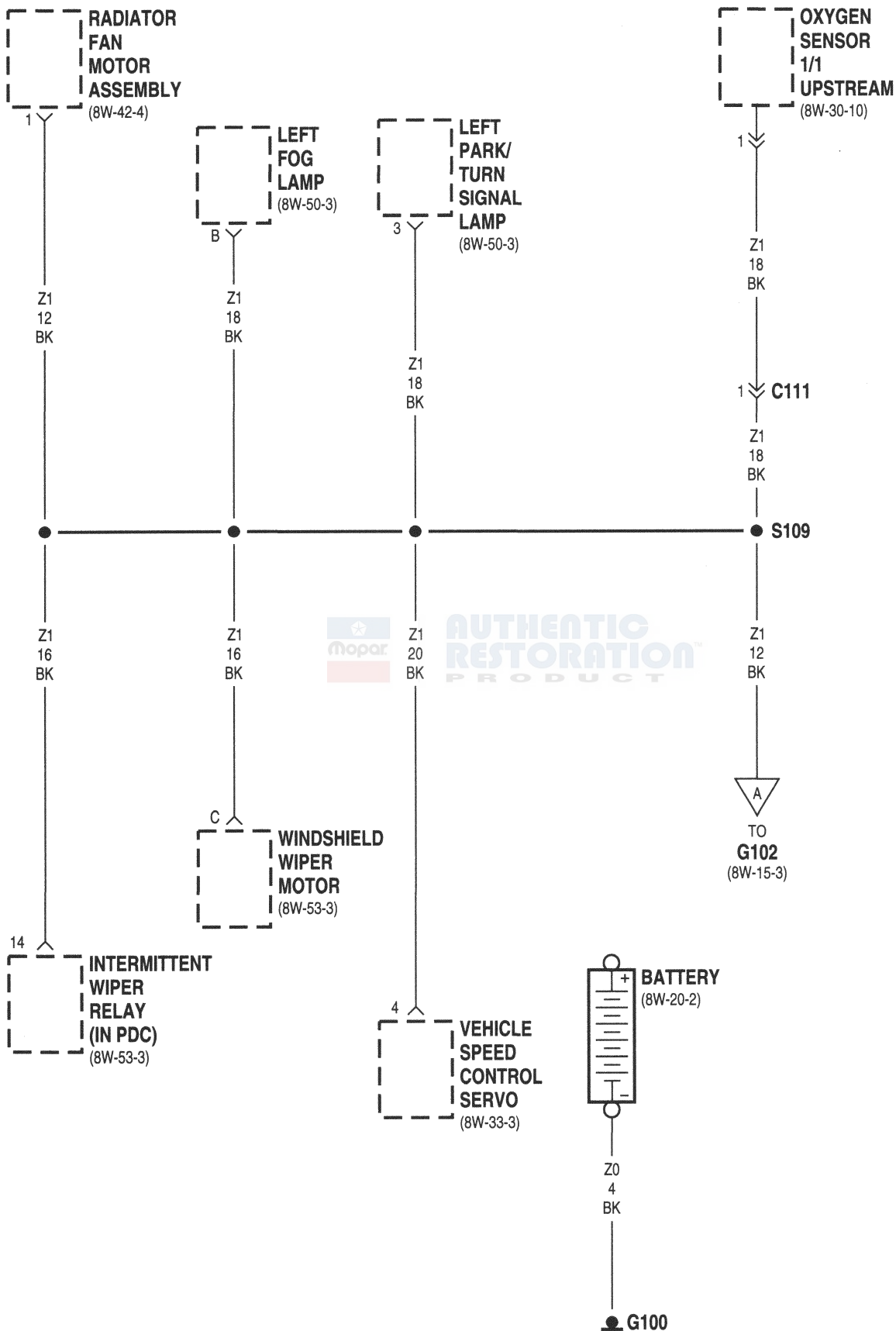


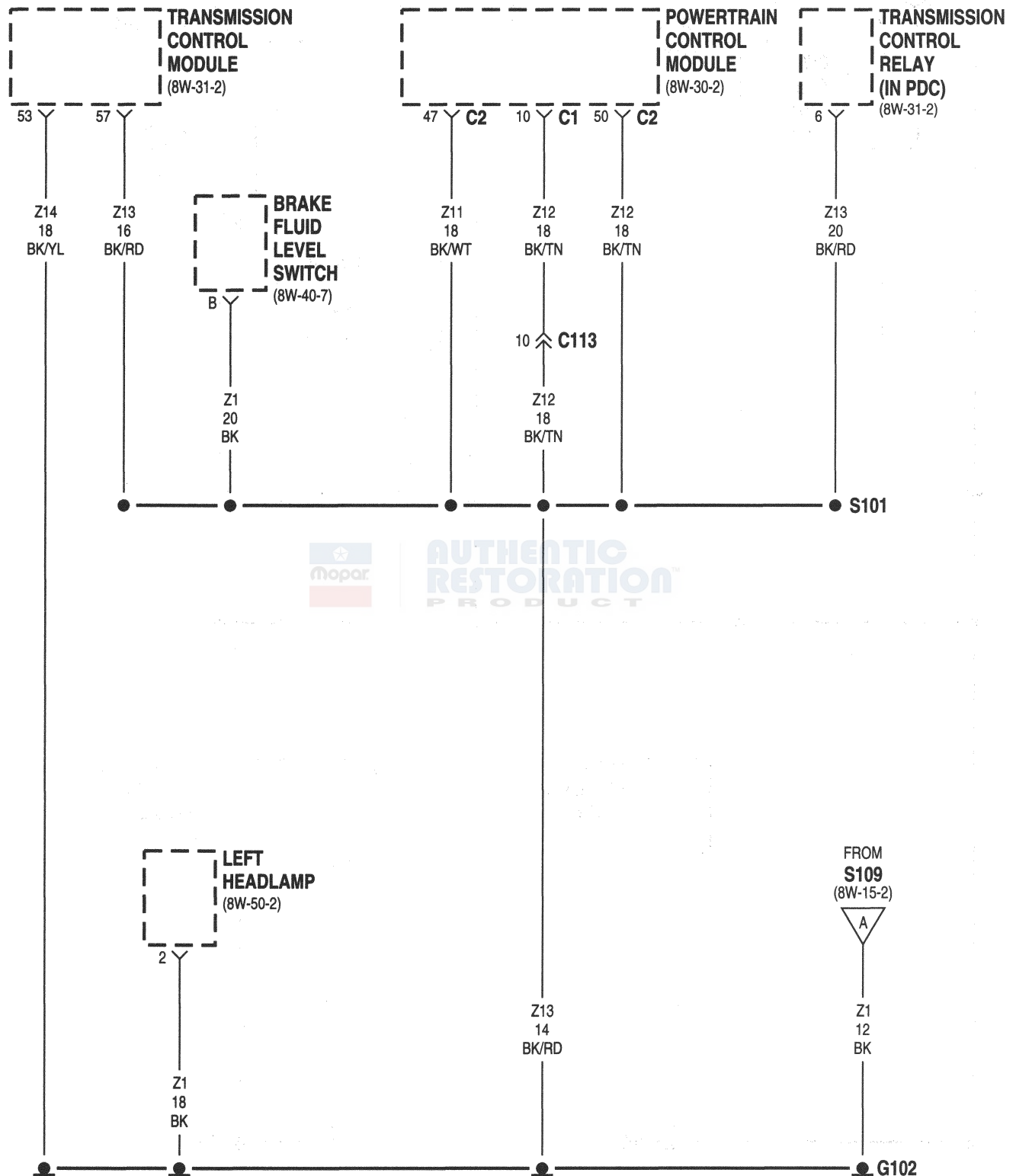


## 8W-15 GROUND DISTRIBUTION

Component	Page	Component	Page
A/C- Heater Control . . . . .	8W-15-5	Left Power Mirror . . . . .	8W-15-8
Airbag Control Module . . . . .	8W-15-5	Left Rear Park/Turn Signal Lamp . . . . .	8W-15-7
Ash Receiver Lamp . . . . .	8W-15-5	Left Side Marker Lamp . . . . .	8W-15-7
Automatic Day/Night Mirror . . . . .	8W-15-10	Left Tail/Stop Lamp . . . . .	8W-15-7
Autostick Switch . . . . .	8W-15-10	License Lamp . . . . .	8W-15-7
Battery . . . . .	8W-15-2	Low Note Horn . . . . .	8W-15-4
Body Control Module . . . . .	8W-15-5, 10	Master Power Window Switch . . . . .	8W-15-8
Brake Fluid Level Switch . . . . .	8W-15-3	Overhead Map Lamp . . . . .	8W-15-10
Center High Mounted Stop Lamp . . . . .	8W-15-6	Oxygen Sensor 1/1 Upstream . . . . .	8W-15-2
Cigar Lighter/Power Outlet . . . . .	8W-15-5	Oxygen Sensor 1/2 Downstream . . . . .	8W-15-4
Controller Anti-Lock Brake . . . . .	8W-15-4	Passenger Seat Belt Solenoid . . . . .	8W-15-9
Data Link Connector . . . . .	8W-15-10	Power Amplifier . . . . .	8W-15-10
Daytime Running Lamp Module . . . . .	8W-15-10	Power Antenna . . . . .	8W-15-6
Decklid Solenoid . . . . .	8W-15-6	Power Mirror Switch . . . . .	8W-15-8
Distributor . . . . .	8W-15-5	Power Seat Switch . . . . .	8W-15-9
Driver Seat Belt Solenoid . . . . .	8W-15-9	Power Steering Pressure Switch . . . . .	8W-15-10
Fuel Pump Module . . . . .	8W-15-6	Power Top Switch . . . . .	8W-15-9
G100 . . . . .	8W-15-2	Power Top Up/Down Relays . . . . .	8W-15-6
G102 . . . . .	8W-15-3	Powertrain Control Module . . . . .	8W-15-3
G103 . . . . .	8W-15-4	PRNDL Illumination LED . . . . .	8W-15-9
G104 . . . . .	8W-15-4	Radiator Fan Motor Assembly . . . . .	8W-15-2
G105 . . . . .	8W-15-5	Radio . . . . .	8W-15-5
G200 . . . . .	8W-15-5	Rear Window Defogger . . . . .	8W-15-6
G201 . . . . .	8W-15-5	Right Back-Up Lamp . . . . .	8W-15-7
G300 . . . . .	8W-15-6	Right Door Window Motor Relay . . . . .	8W-15-8
G301 . . . . .	8W-15-10	Right Fog Lamp . . . . .	8W-15-4
G302 . . . . .	8W-15-6	Right Headlamp . . . . .	8W-15-4
G303 . . . . .	8W-15-6	Right Park/Turn Signal Lamp . . . . .	8W-15-4
G304 . . . . .	8W-15-6	Right Power Door Lock Switch . . . . .	8W-15-9
G306 . . . . .	8W-15-9	Right Power Mirror . . . . .	8W-15-9
G307 . . . . .	8W-15-7	Right Rear Park/Turn Signal Lamp . . . . .	8W-15-7
Glove Box Lamp . . . . .	8W-15-5	Right Side Marker Lamp . . . . .	8W-15-7
Headlamp Switch . . . . .	8W-15-10	Right Tail/Stop Lamp . . . . .	8W-15-7
High Note Horn . . . . .	8W-15-4	Seat Belt Control Module . . . . .	8W-15-6, 9
Ignition Switch . . . . .	8W-15-10	Seat Belt Switch . . . . .	8W-15-9
Illuminated Entry Relay . . . . .	8W-15-10	Sentry Key Immobilizer Module . . . . .	8W-15-10
Instrument Cluster . . . . .	8W-15-10	Traction Control Switch . . . . .	8W-15-10
Intermittent Wiper Relay . . . . .	8W-15-2	Transmission Control Module . . . . .	8W-15-3
Junction Block . . . . .	8W-15-10	Transmission Control Relay . . . . .	8W-15-3
Key-In Switch . . . . .	8W-15-10	Traveler . . . . .	8W-15-5
Left Back-Up Lamp . . . . .	8W-15-7	Trunk Key Cylinder Switch . . . . .	8W-15-6
Left Door Window Motor Relay . . . . .	8W-15-8	Vehicle Speed Control Servo . . . . .	8W-15-2
Left Fog Lamp . . . . .	8W-15-2	Washer Fluid Level Switch . . . . .	8W-15-4
Left Headlamp . . . . .	8W-15-3	Window Timer Module . . . . .	8W-15-8
Left Park/Turn Signal Lamp . . . . .	8W-15-2	Windshield Washer Pump . . . . .	8W-15-4
Left Power Door Lock Switch . . . . .	8W-15-8	Windshield Wiper Motor . . . . .	8W-15-2

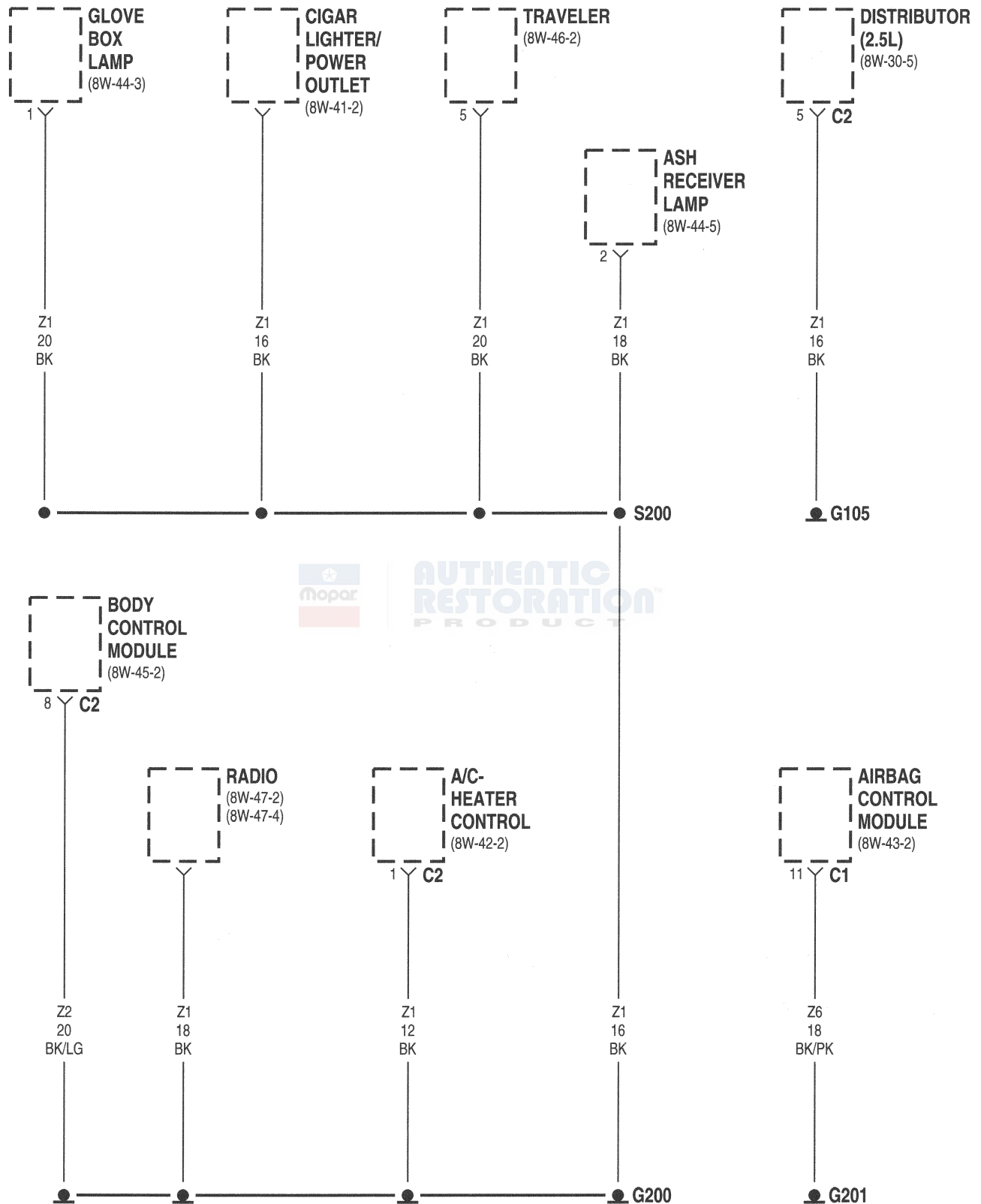


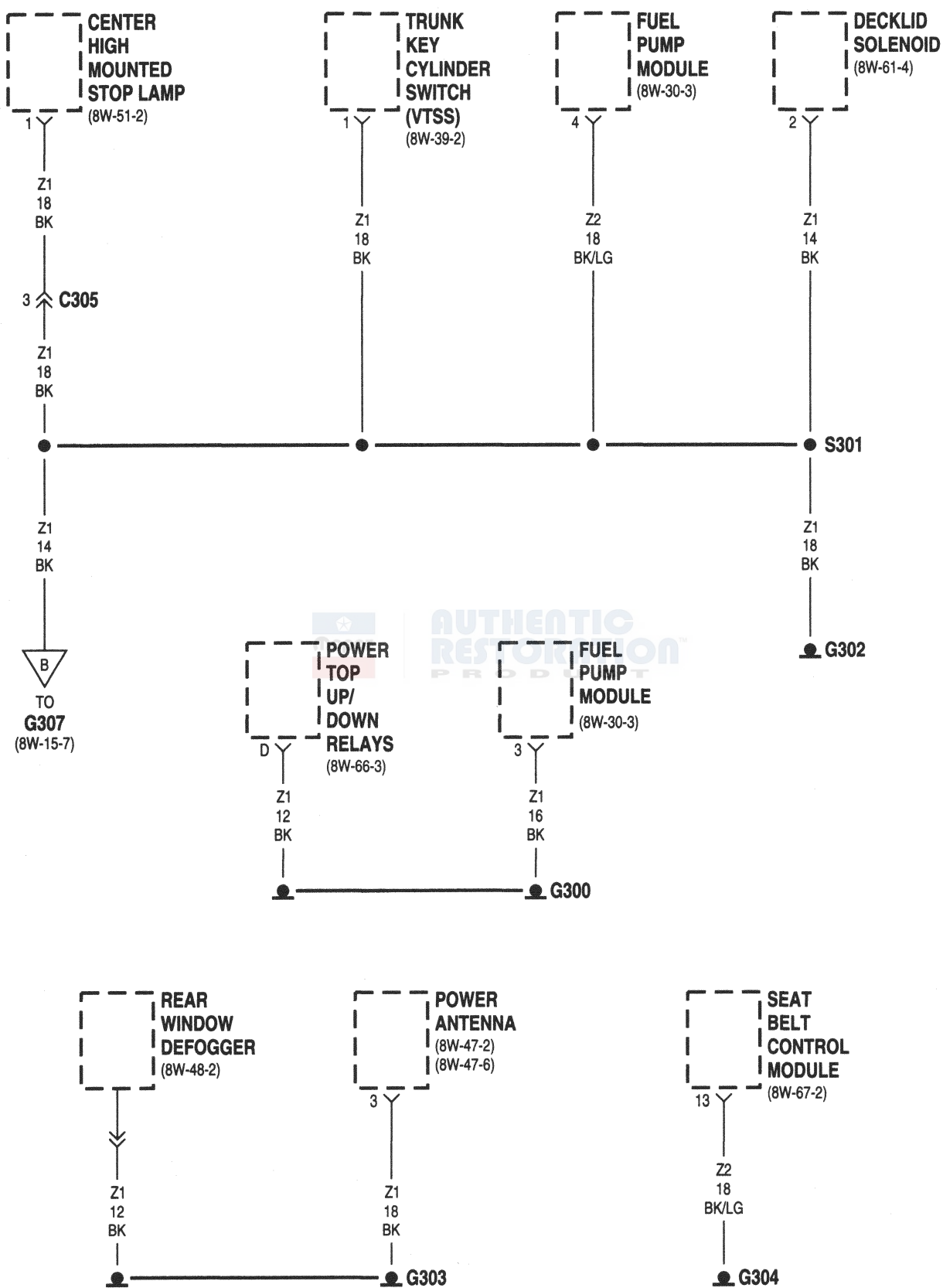


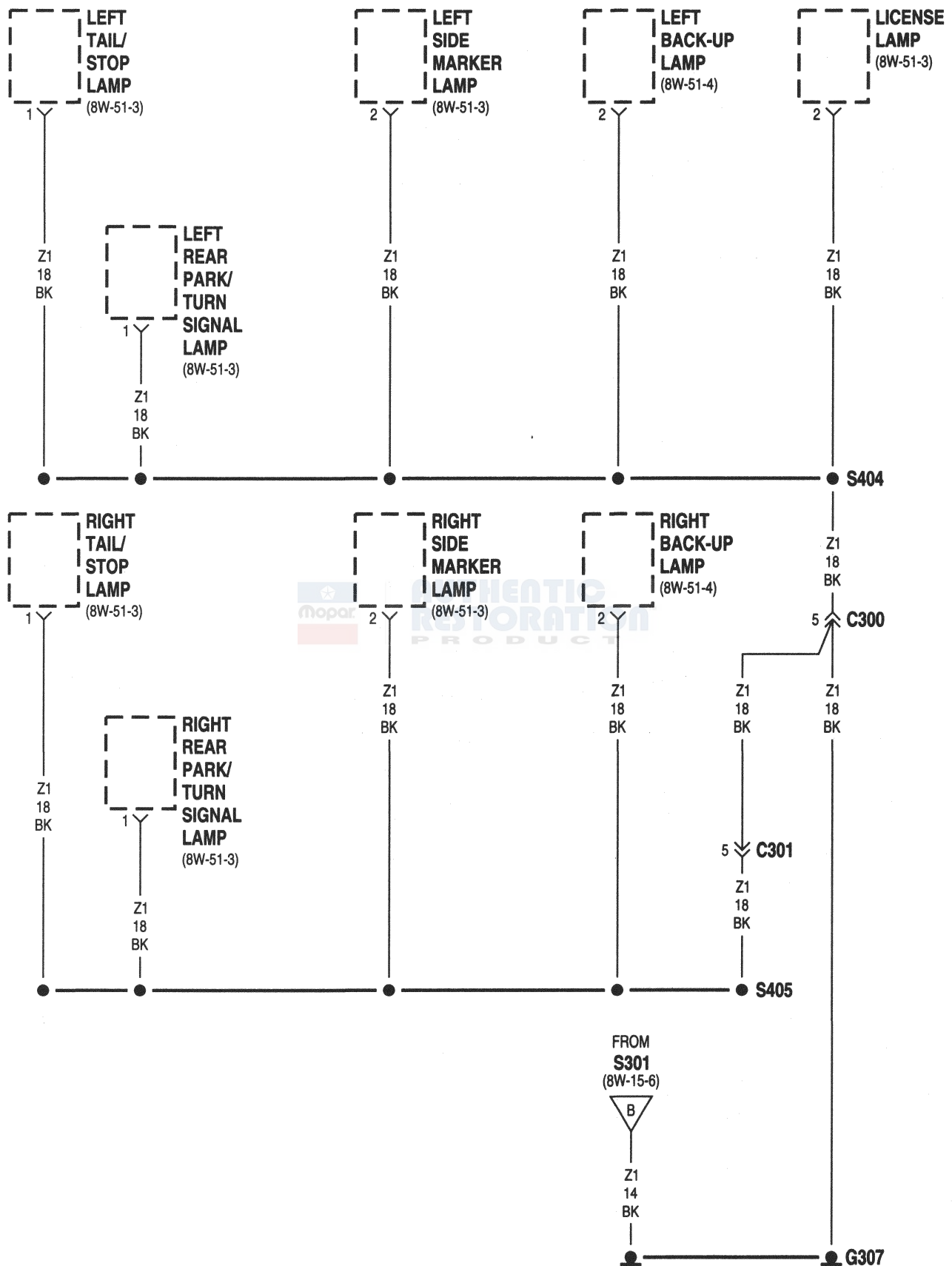




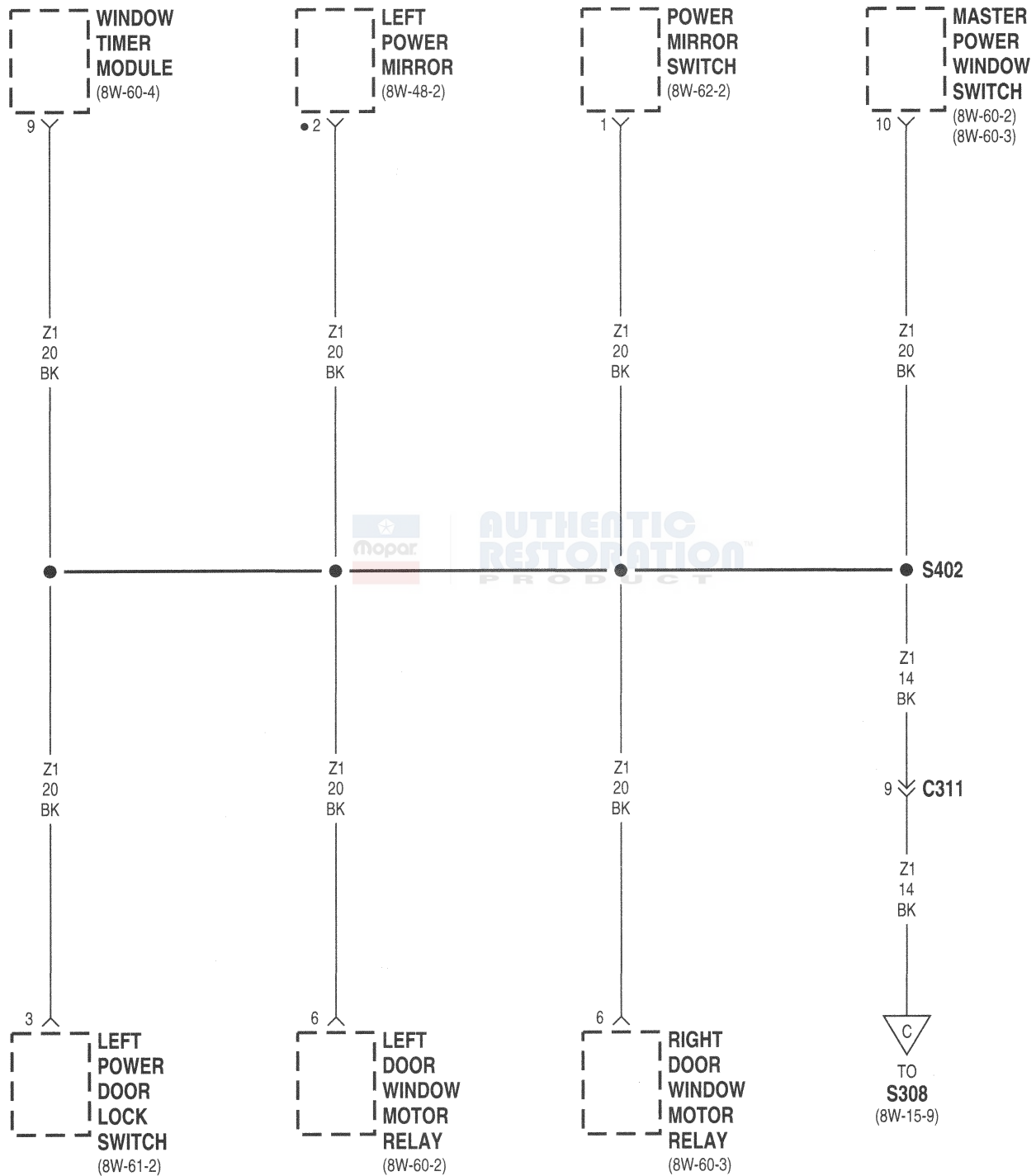




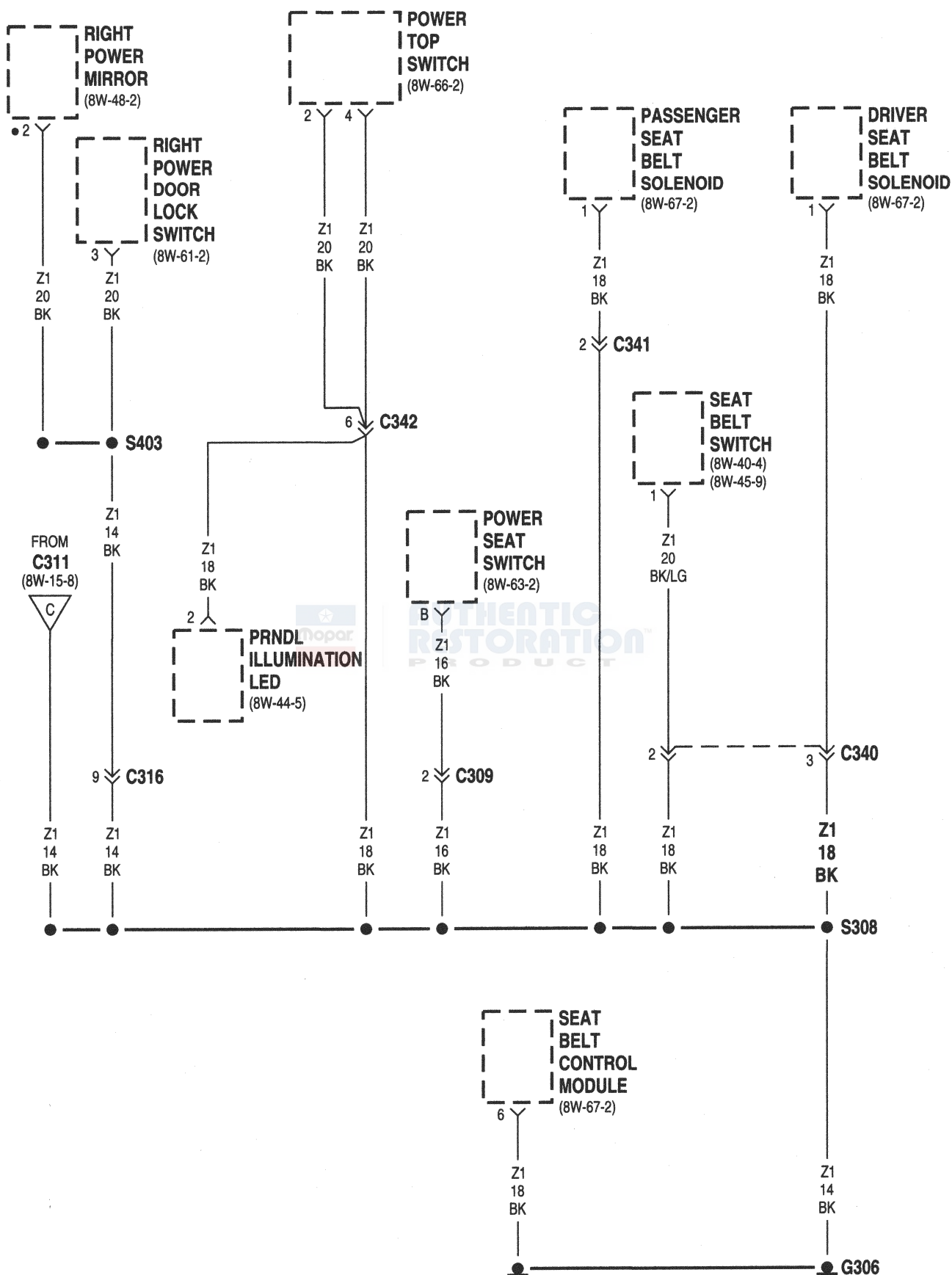


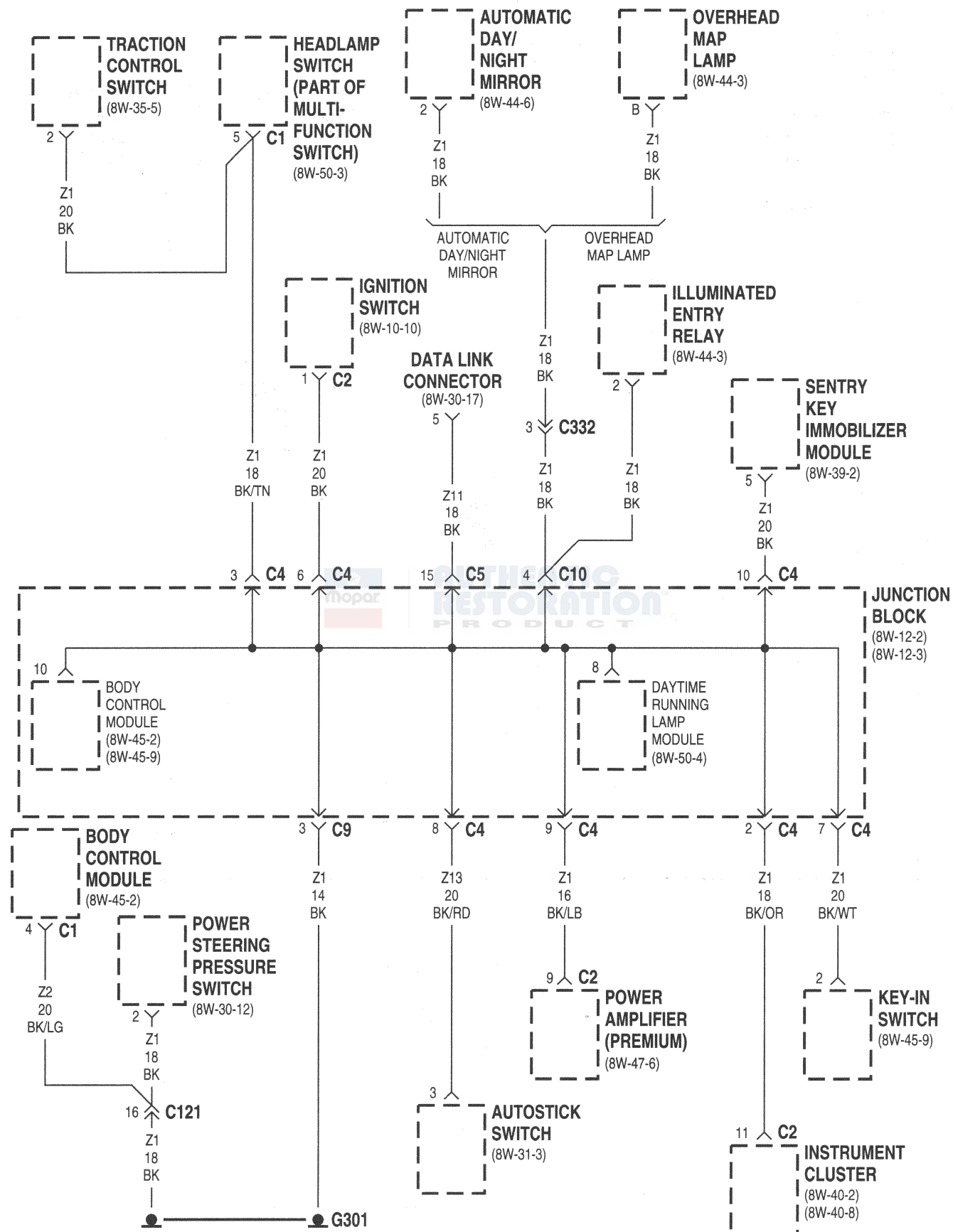






● HEATED MIRRORS





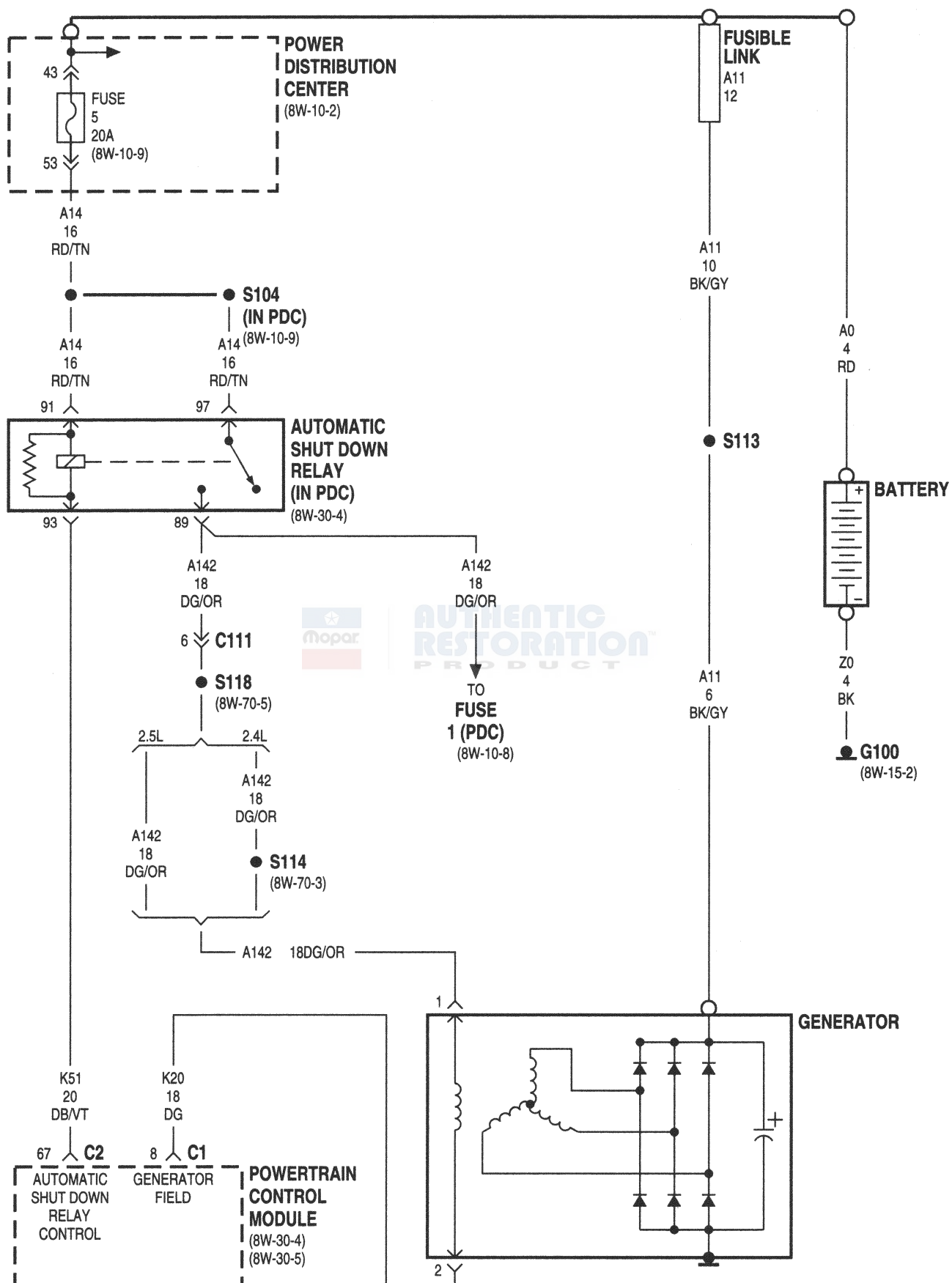


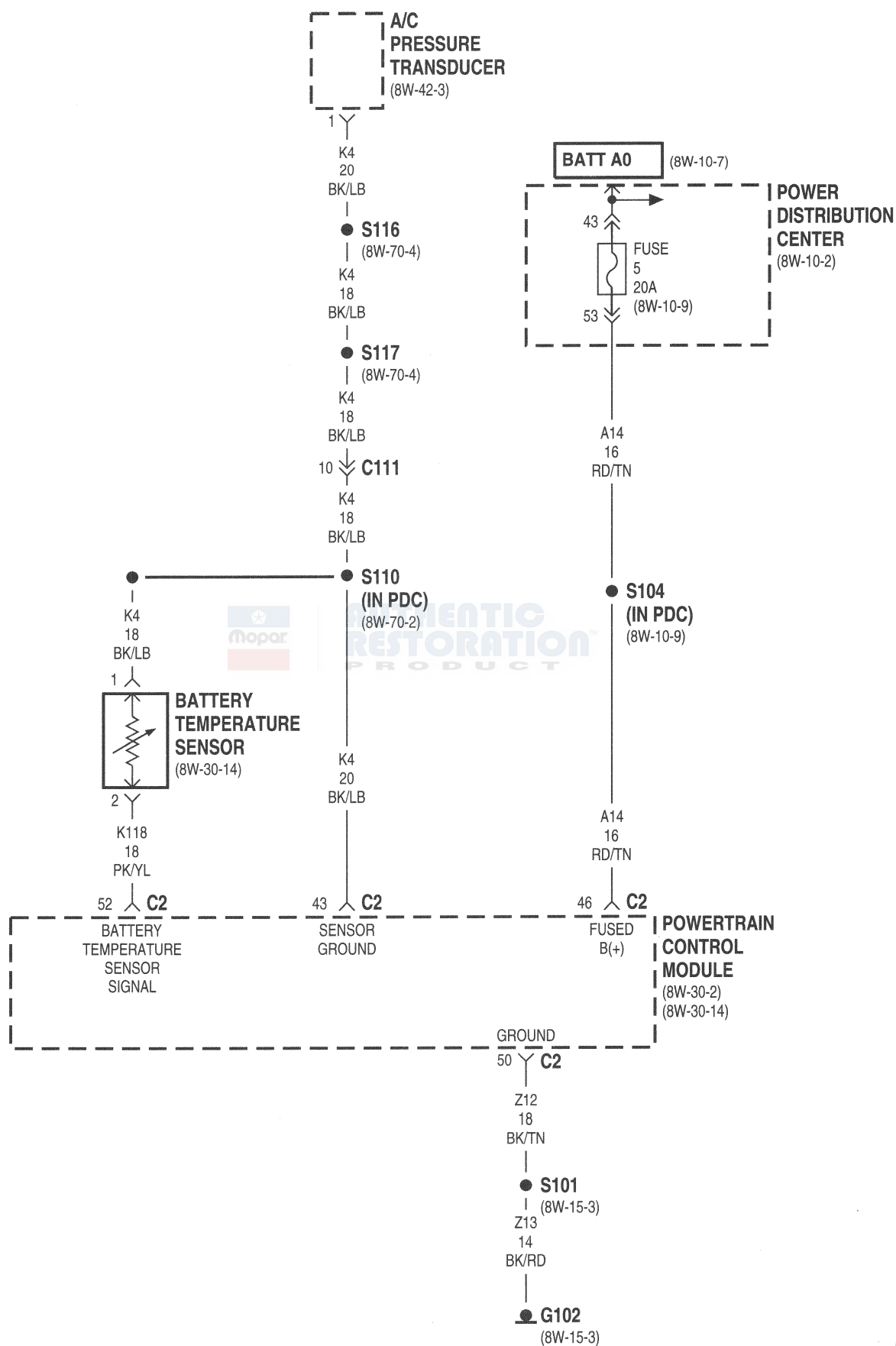
## **8W-20 CHARGING SYSTEM**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
A/C Pressure Transducer .....	8W-20-3	Fusible Link .....	8W-20-2
Automatic Shut Down Relay .....	8W-20-2	G100 .....	8W-20-2
Battery .....	8W-20-2	G102 .....	8W-20-3
Battery Temperature Sensor .....	8W-20-3	Generator .....	8W-20-2
Fuse 1 (PDC) .....	8W-20-2	Power Distribution Center .....	8W-20-2, 3
Fuse 5 (PDC) .....	8W-20-2, 3	Powertrain Control Module .....	8W-20-2, 3



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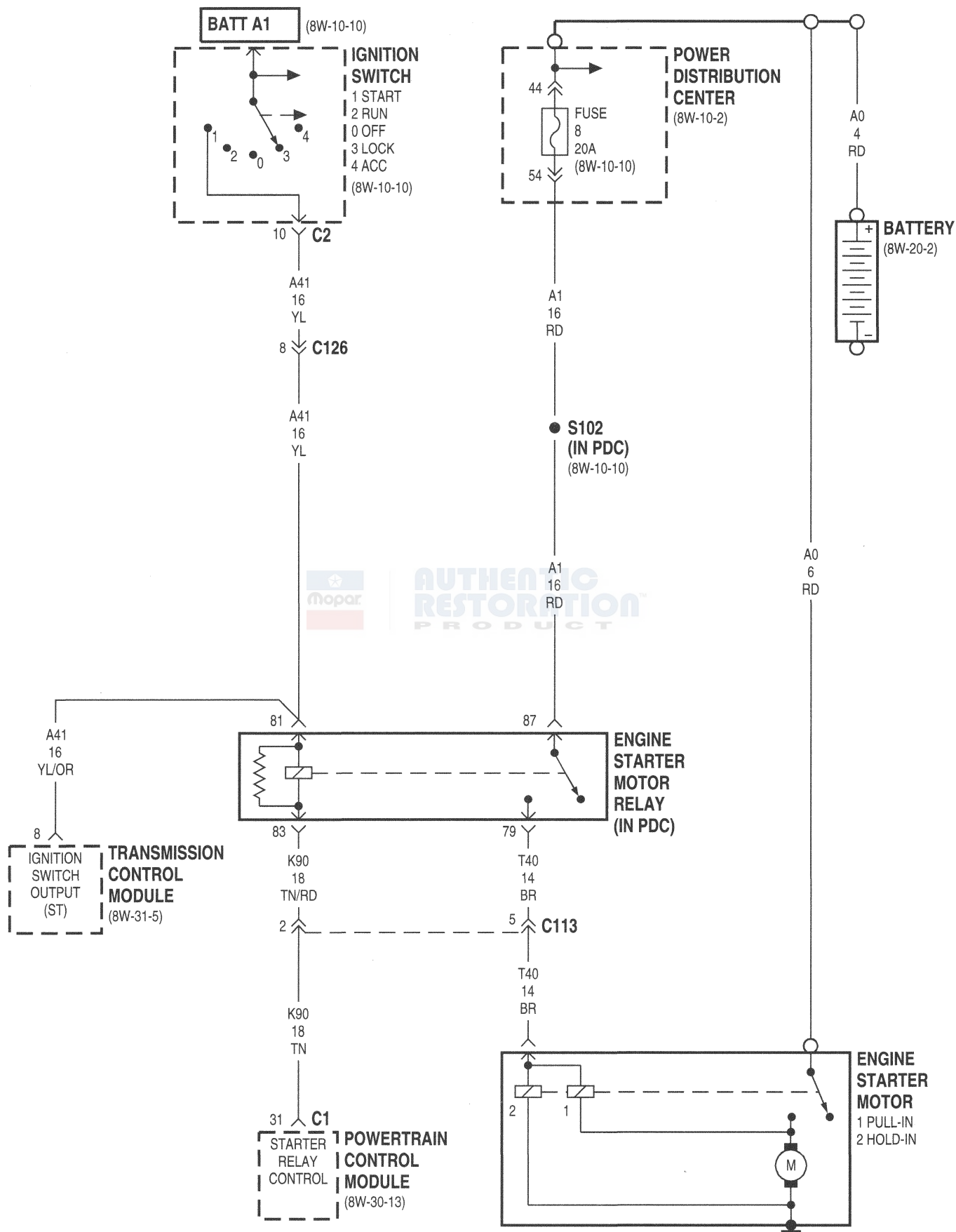


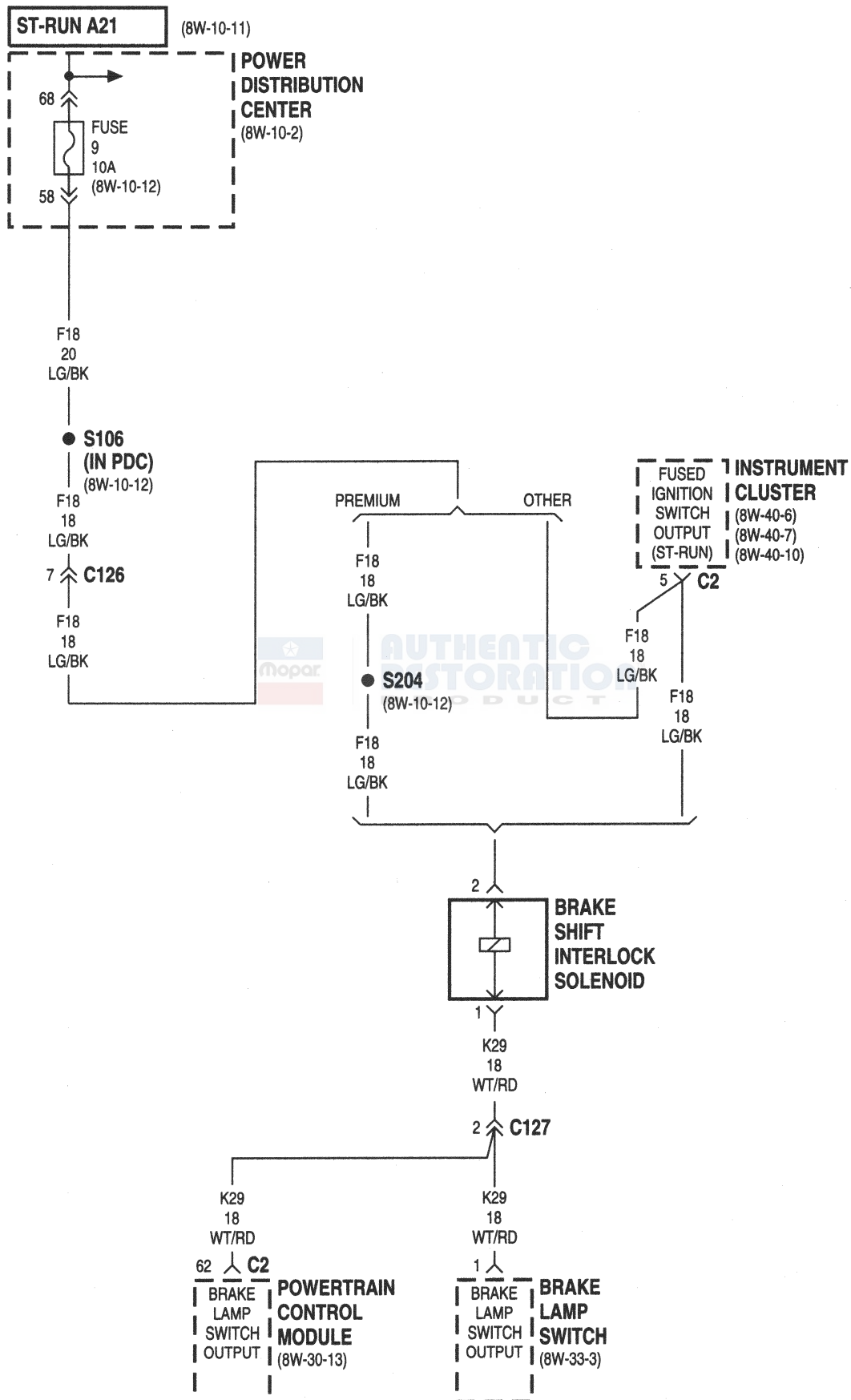
## **8W-21 STARTING SYSTEM**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Battery .....	8W-21-2	Fuse 9 (PDC) .....	8W-21-3
Brake Lamp Switch .....	8W-21-3	Ignition Switch .....	8W-21-2
Brake Shift Interlock Solenoid .....	8W-21-3	Instrument Cluster .....	8W-21-3
Engine Starter Motor .....	8W-21-2	Power Distribution Center .....	8W-21-2, 3
Engine Starter Motor Relay .....	8W-21-2	Powertrain Control Module .....	8W-21-2, 3
Fuse 8 (PDC) .....	8W-21-2	Transmission Control Module .....	8W-21-2



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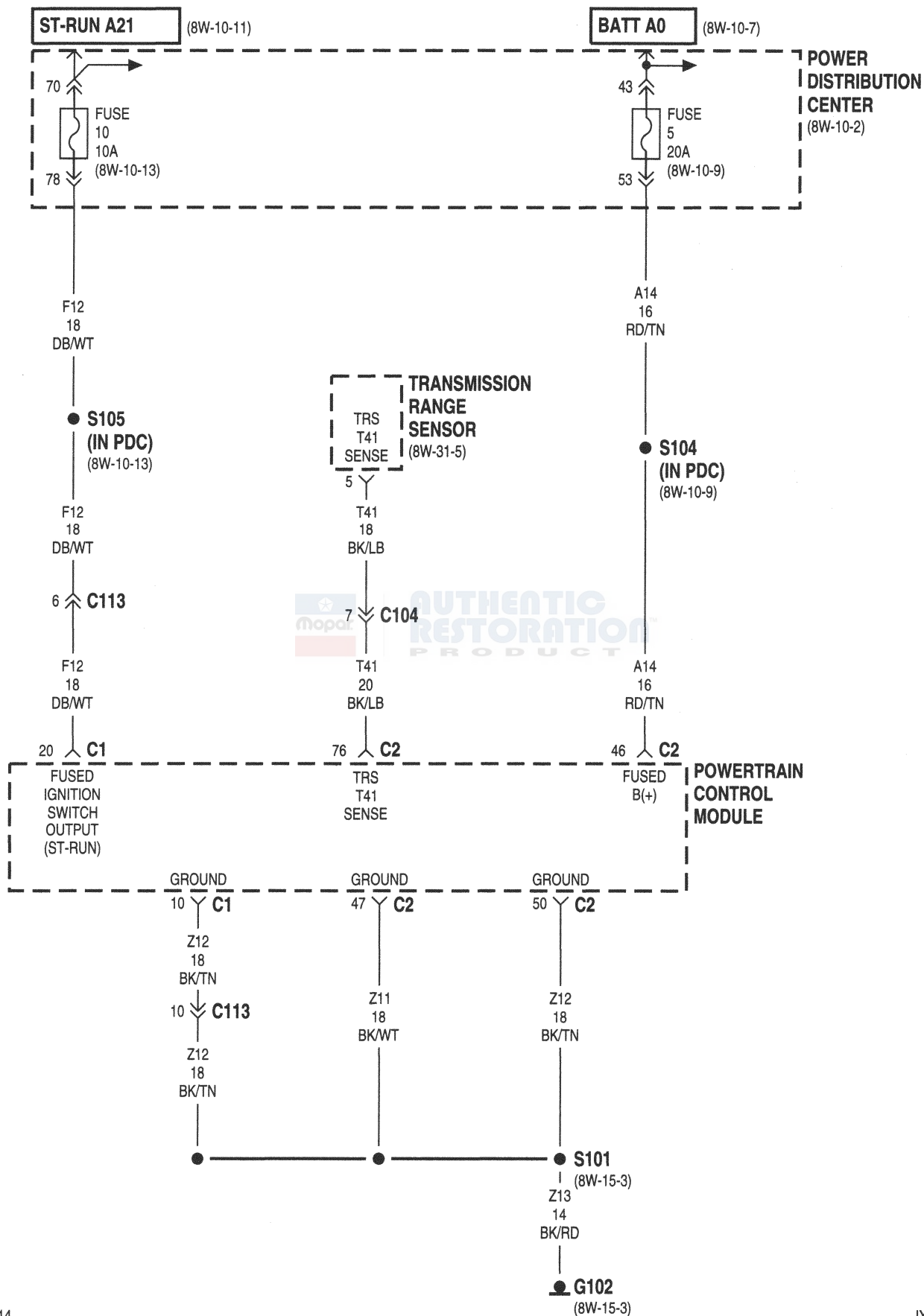






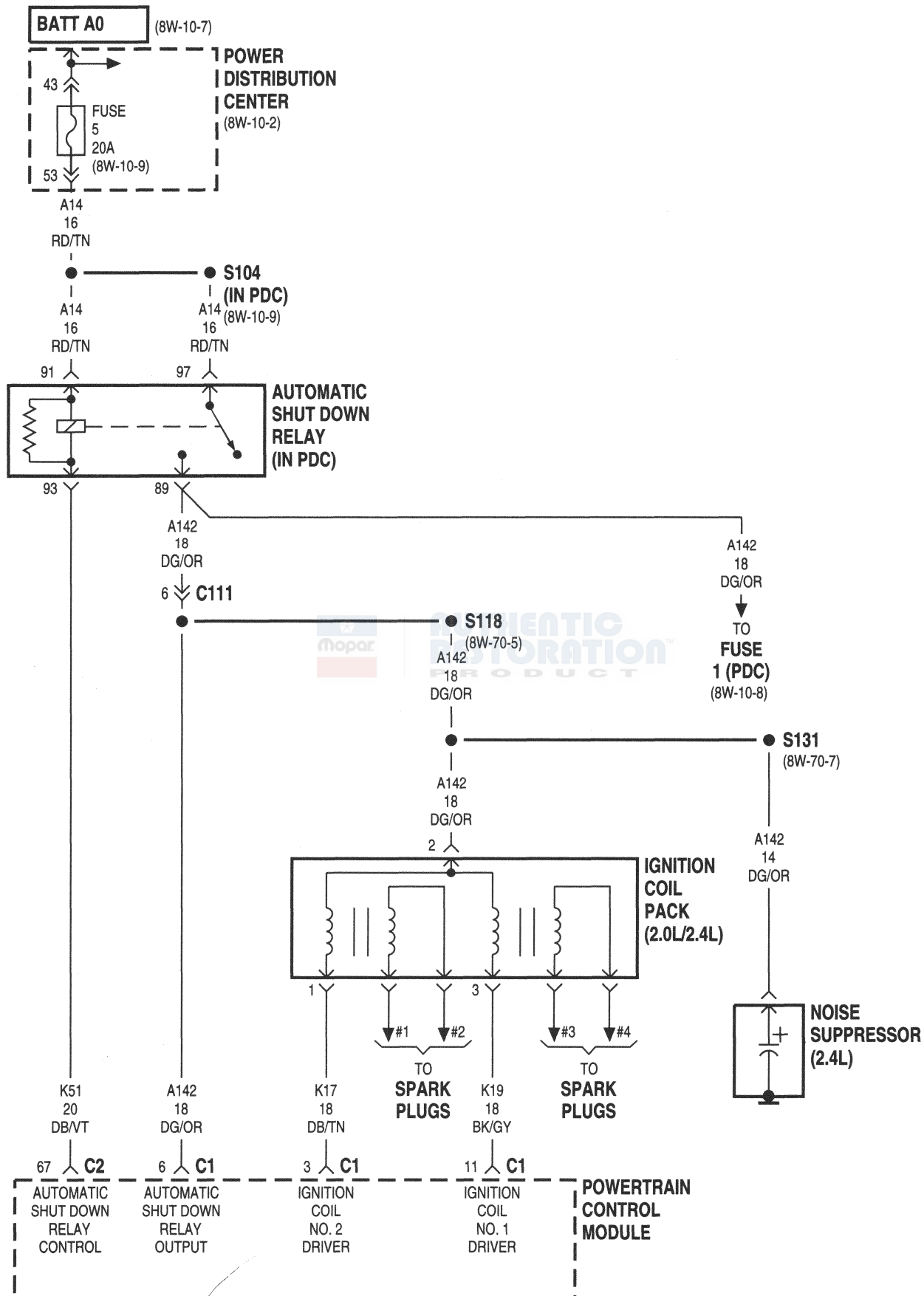
## **8W-30 FUEL/IGNITION SYSTEM**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
A/C Compressor Clutch Relay .....	8W-30-15	G103 .....	8W-30-10
A/C Pressure Transducer .....	8W-30-14	G105 .....	8W-30-5
Automatic Shut Down Relay ....	8W-30-4, 5, 6, 7, 10	G300 .....	8W-30-3
Battery Temperature Sensor .....	8W-30-14	G301 .....	8W-30-12, 17
Body Control Module .....	8W-30-3, 12, 17	G302 .....	8W-30-3
Brake Lamp Switch .....	8W-30-13	G307 .....	8W-30-3
Brake Shift Interlock Solenoid .....	8W-30-13	Generator .....	8W-30-5
Camshaft Position Sensor .....	8W-30-8	High Speed Radiator Fan Relay .....	8W-30-15
Clockspring No. 1 .....	8W-30-13	Idle Air Control Motor .....	8W-30-16
Crankshaft Position Sensor .....	8W-30-8	Ignition Coil Pack .....	8W-30-4
Data Link Connector .....	8W-30-17	Intake Air Temperature Sensor .....	8W-30-11
Distributor .....	8W-30-5	Junction Block .....	8W-30-17
EGR Solenoid .....	8W-30-11	Knock Sensor .....	8W-30-12
Engine Coolant Temperature Sensor ....	8W-30-12	Low Speed Radiator Fan Relay .....	8W-30-15
Engine Starter Motor Relay .....	8W-30-13	Manifold Absolute Pressure Sensor .....	8W-30-11
Fuel Injector No. 1 .....	8W-30-6, 7	Noise Suppressor .....	8W-30-4
Fuel Injector No. 2 .....	8W-30-6, 7	Oxygen Sensor 1/1 Upstream .....	8W-30-10
Fuel Injector No. 3 .....	8W-30-6, 7	Oxygen Sensor 1/2 Downstream .....	8W-30-10
Fuel Injector No. 4 .....	8W-30-6, 7	Power Distribution Center .	8W-30-2, 3, 4, 5, 6, 7, 13, 15
Fuel Injector No. 5 .....	8W-30-7	Power Steering Pressure Switch .....	8W-30-12
Fuel Injector No. 6 .....	8W-30-7	Powertrain Control Module .	8W-30-2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17
Fuel Pump Module .....	8W-30-3	Proportional Purge Solenoid .....	8W-30-16
Fuel Pump Relay .....	8W-30-3	Throttle Position Sensor .....	8W-30-9
Fuse 1 (PDC) .....	8W-30-4, 5, 6, 7, 10	Transmission Control Module .....	8W-30-13, 16, 17
Fuse 10 (PDC) .....	8W-30-2, 3	Transmission Range Sensor .....	8W-30-2
Fuse 5 (JB) .....	8W-30-17	Vehicle Speed Control .....	8W-30-13
Fuse 5 (PDC) .....	8W-30-2, 4	Vehicle Speed Control Servo .....	8W-30-13
Fuse 8 (PDC) .....	8W-30-3		
Fuse 9 (PDC) .....	8W-30-3, 15		
G102 .....	8W-30-2, 10		

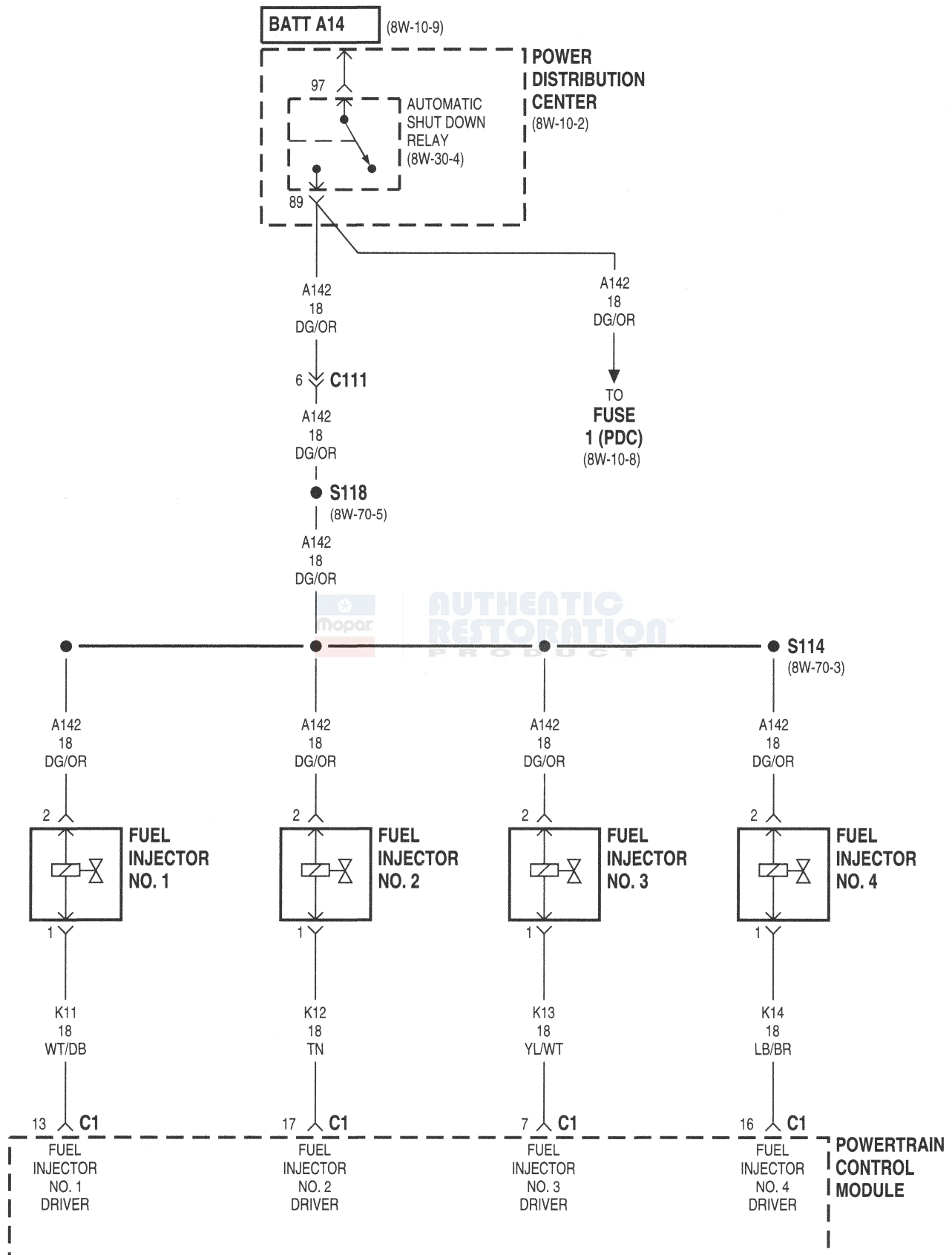




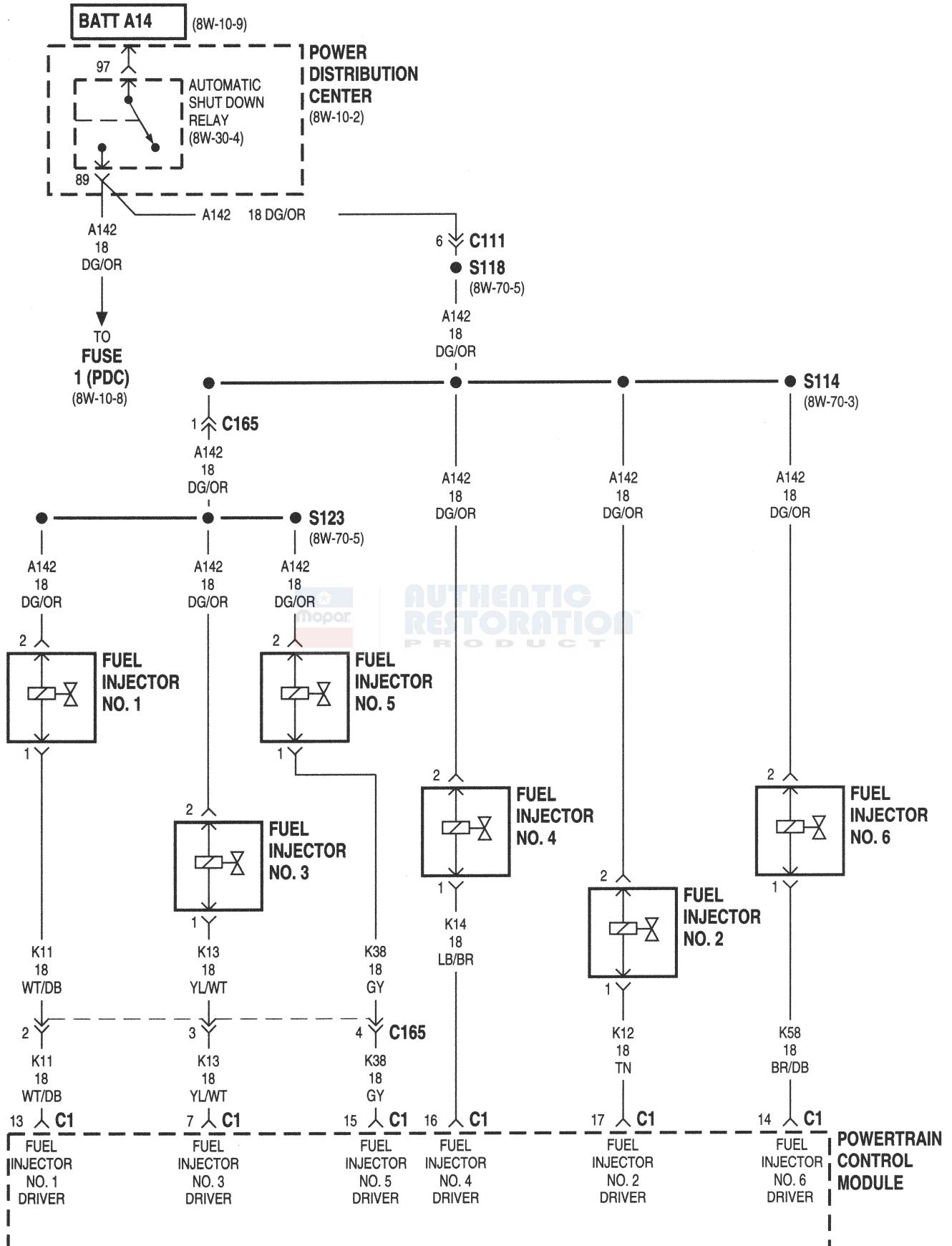


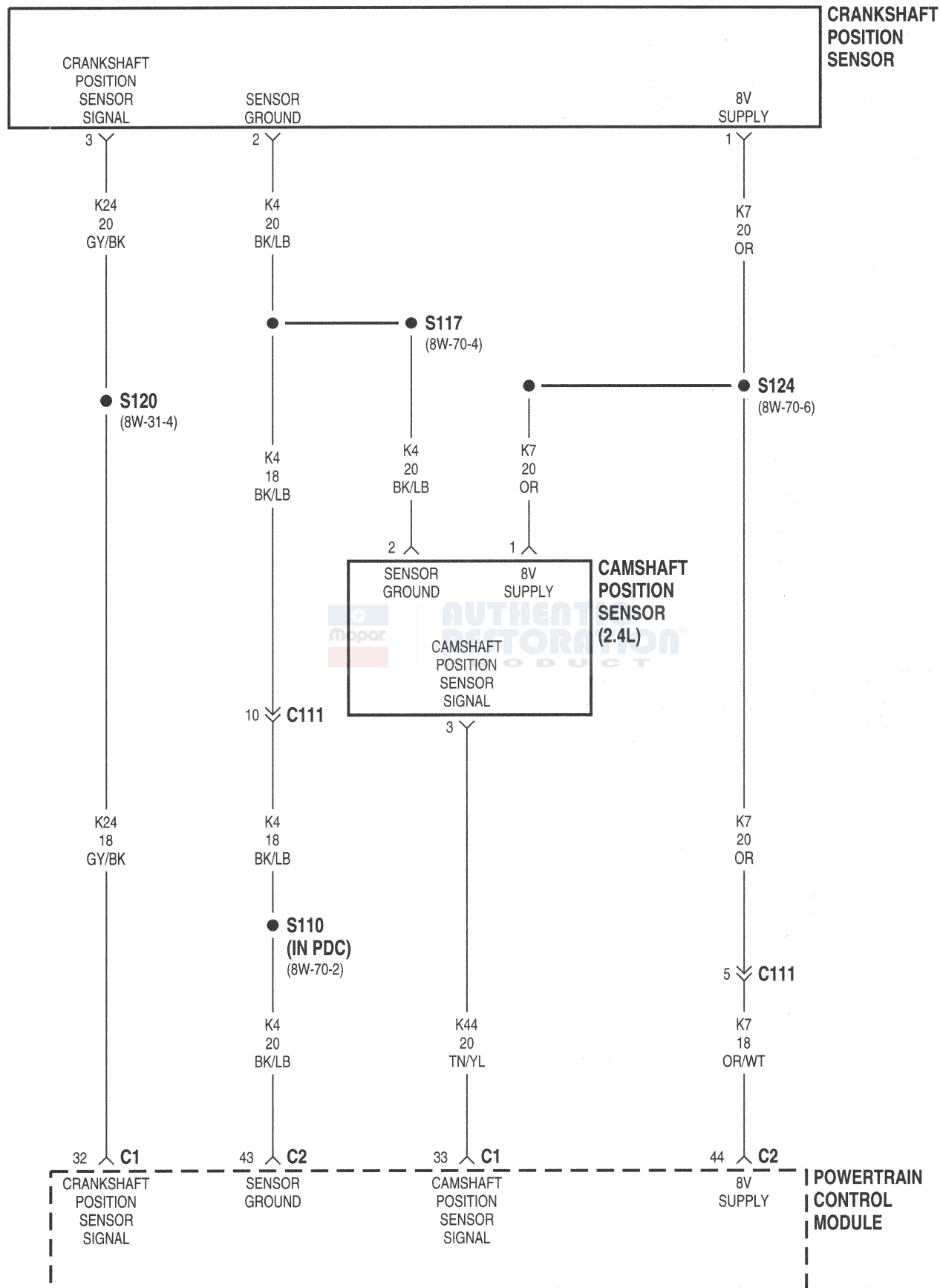


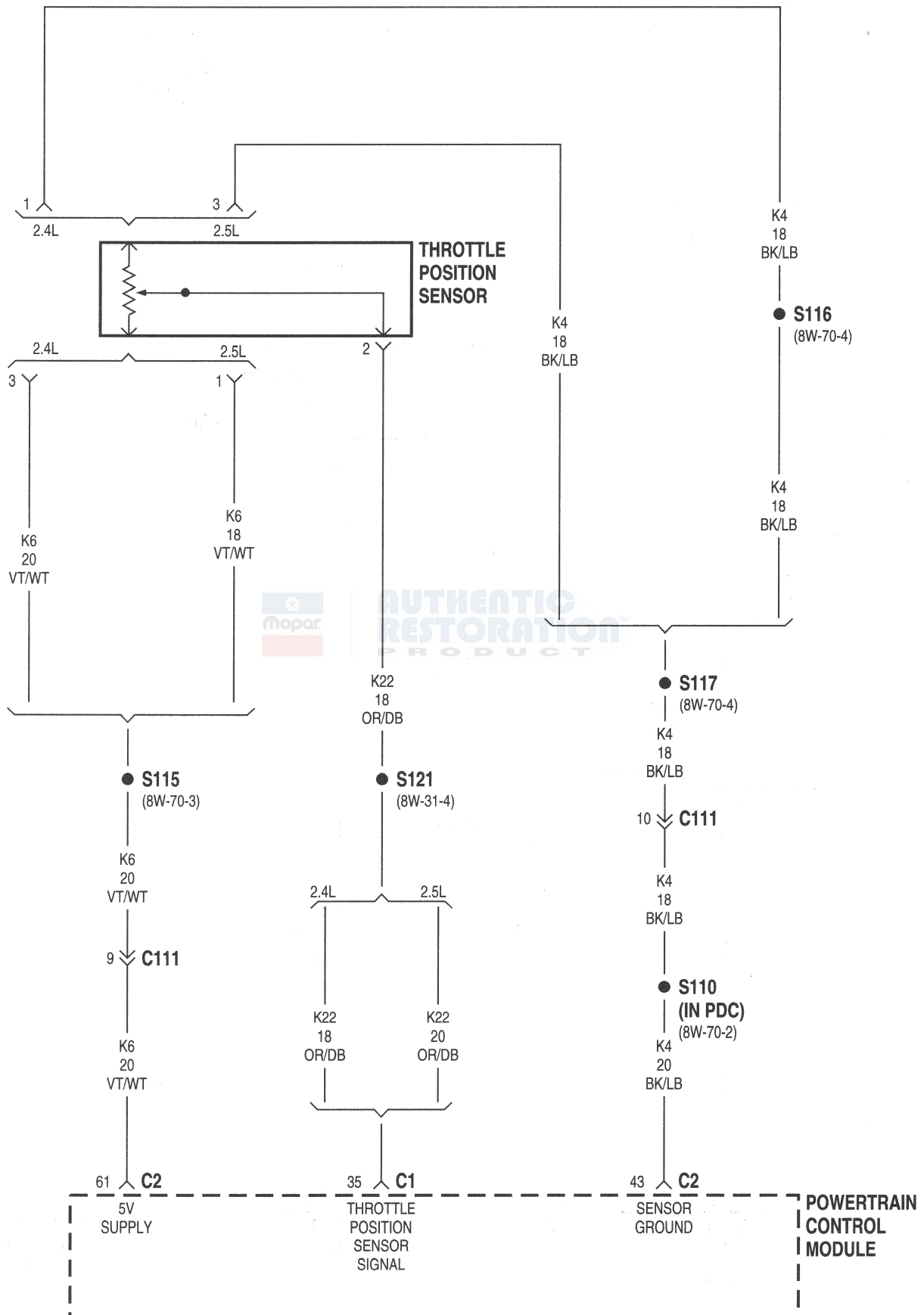




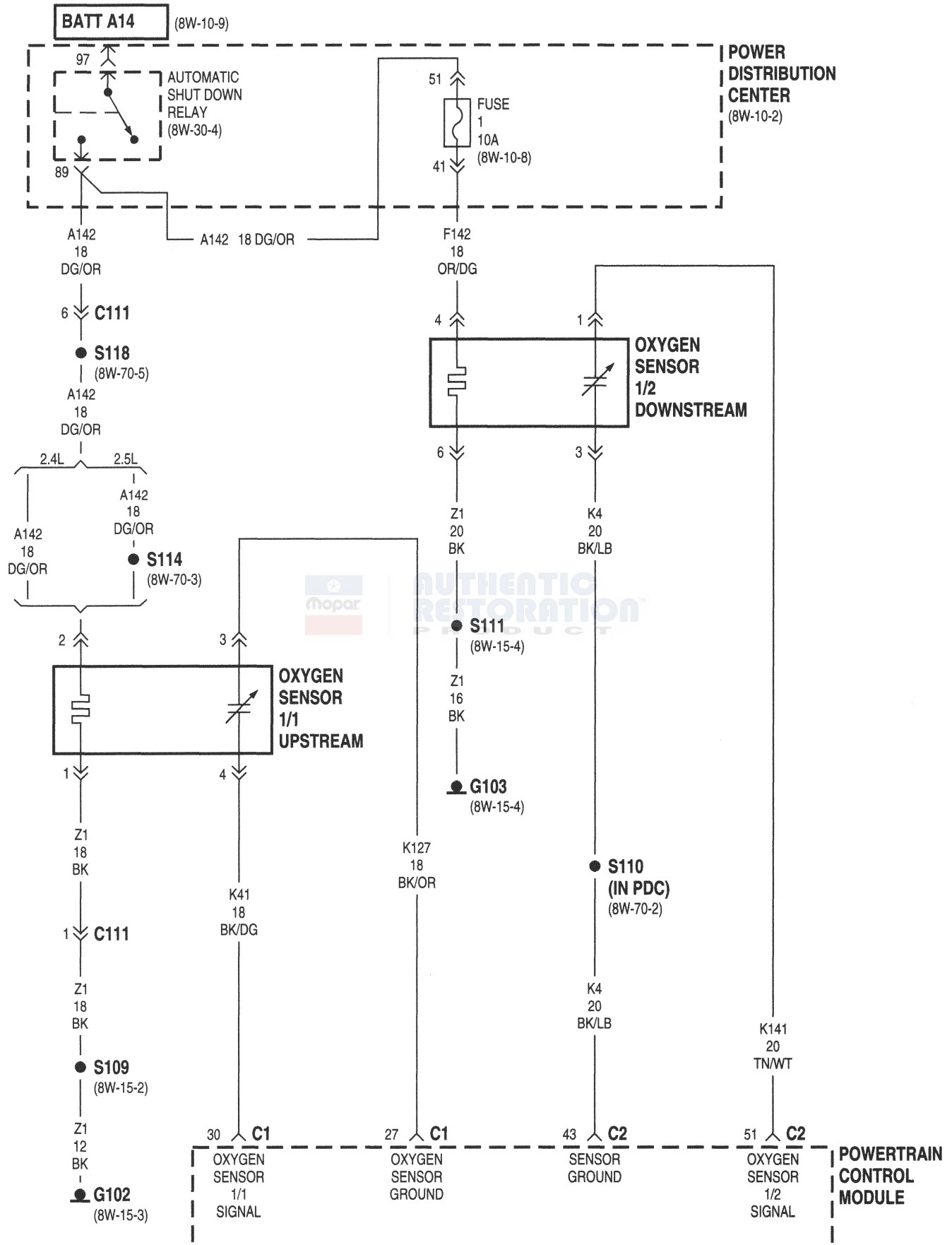


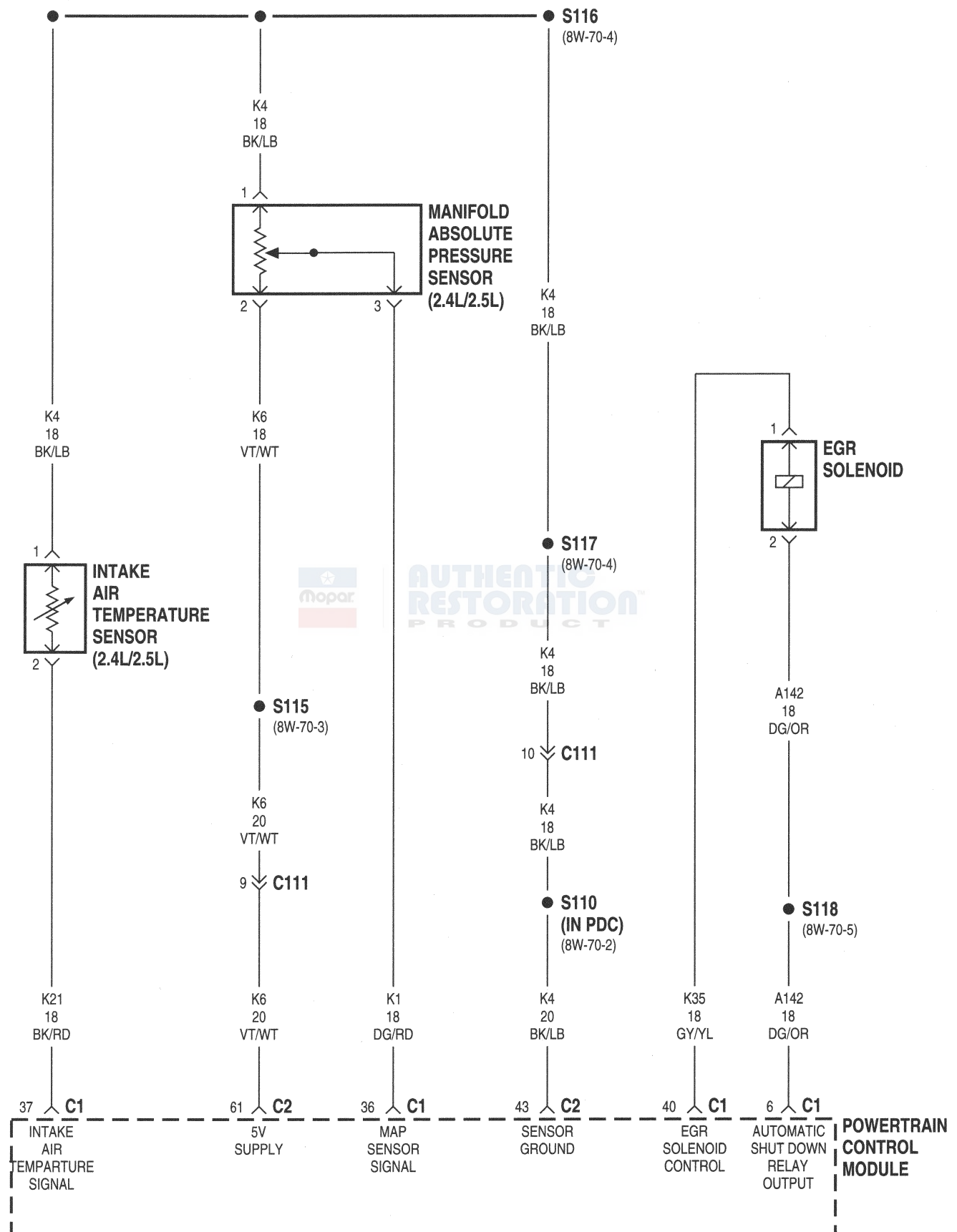


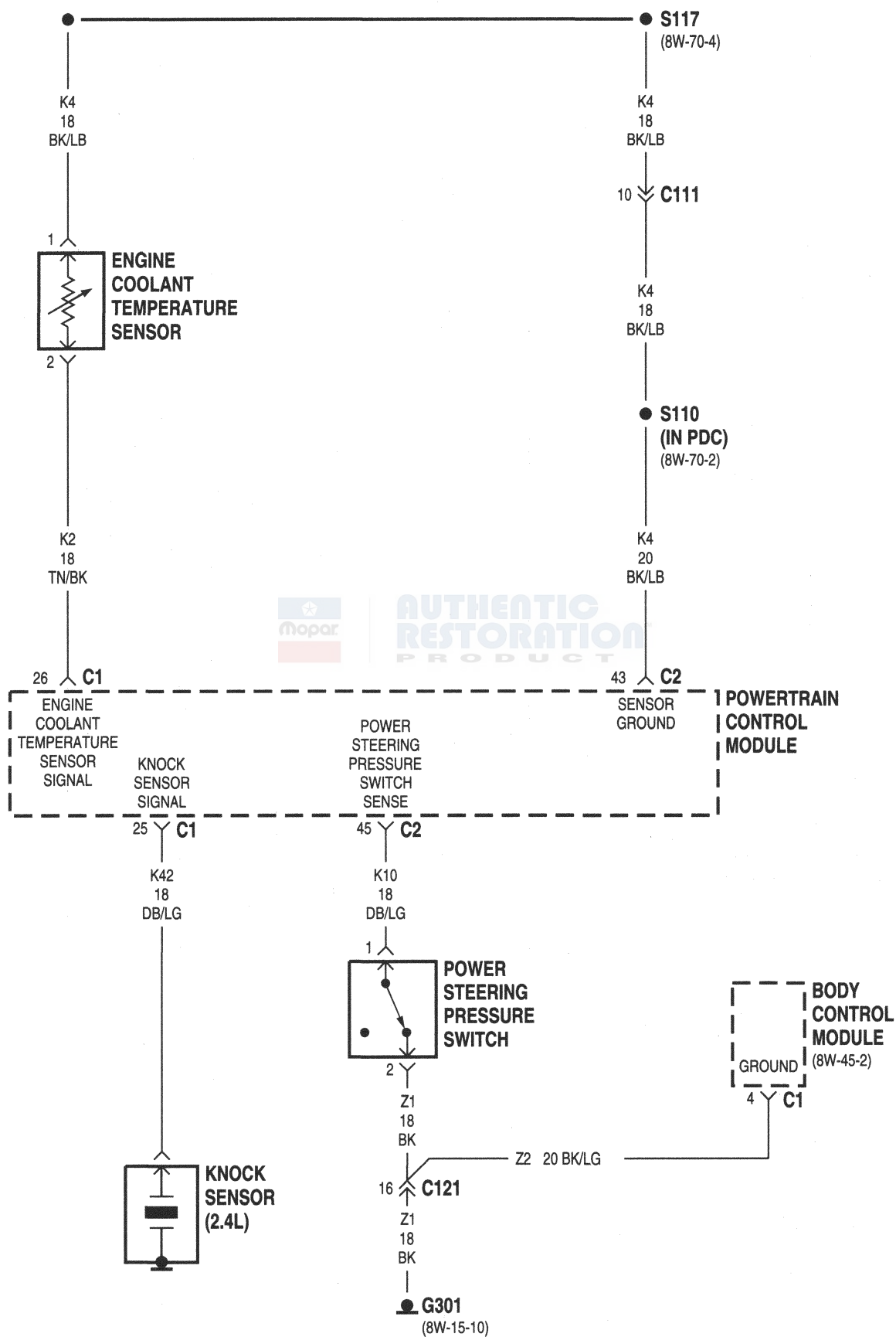




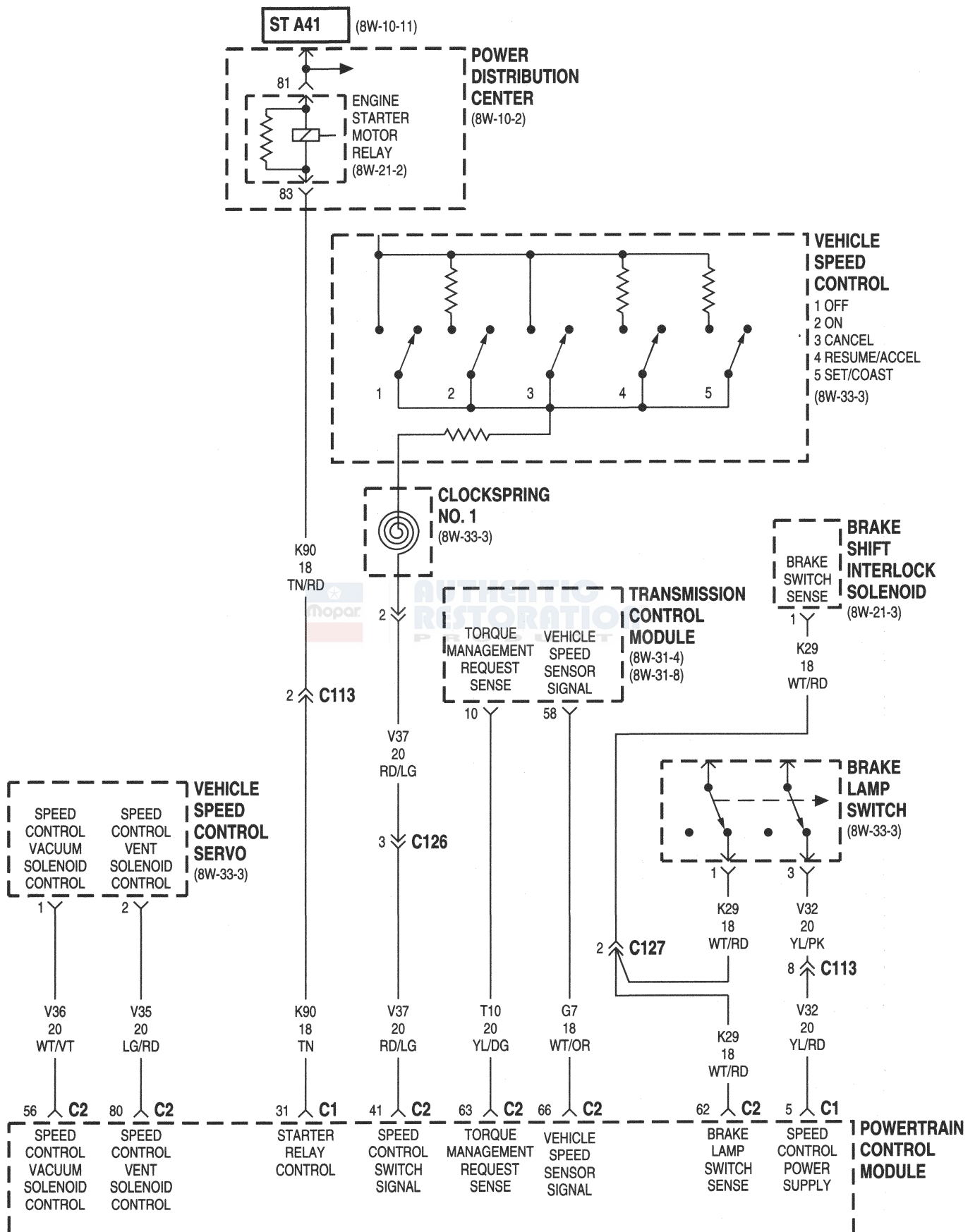


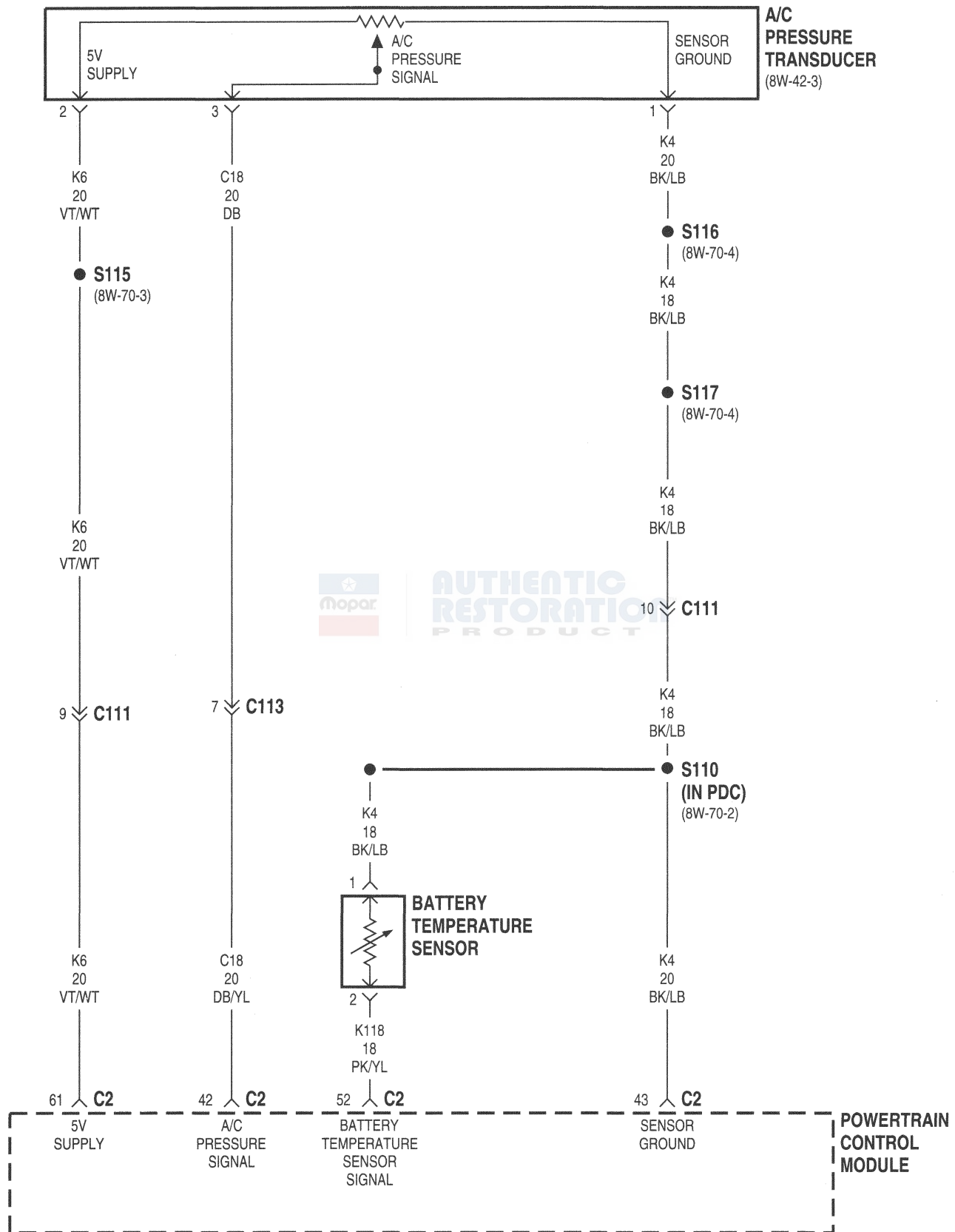


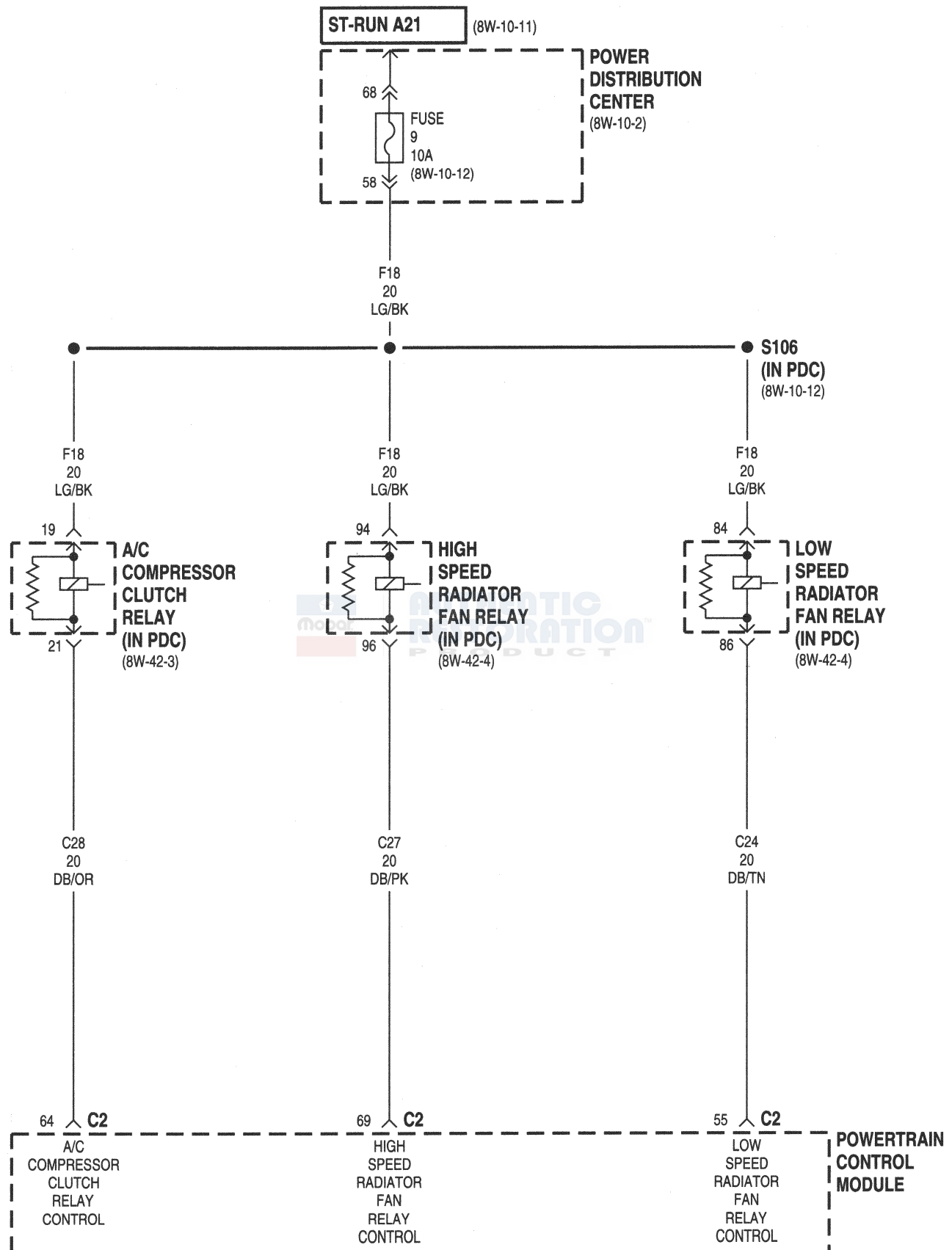




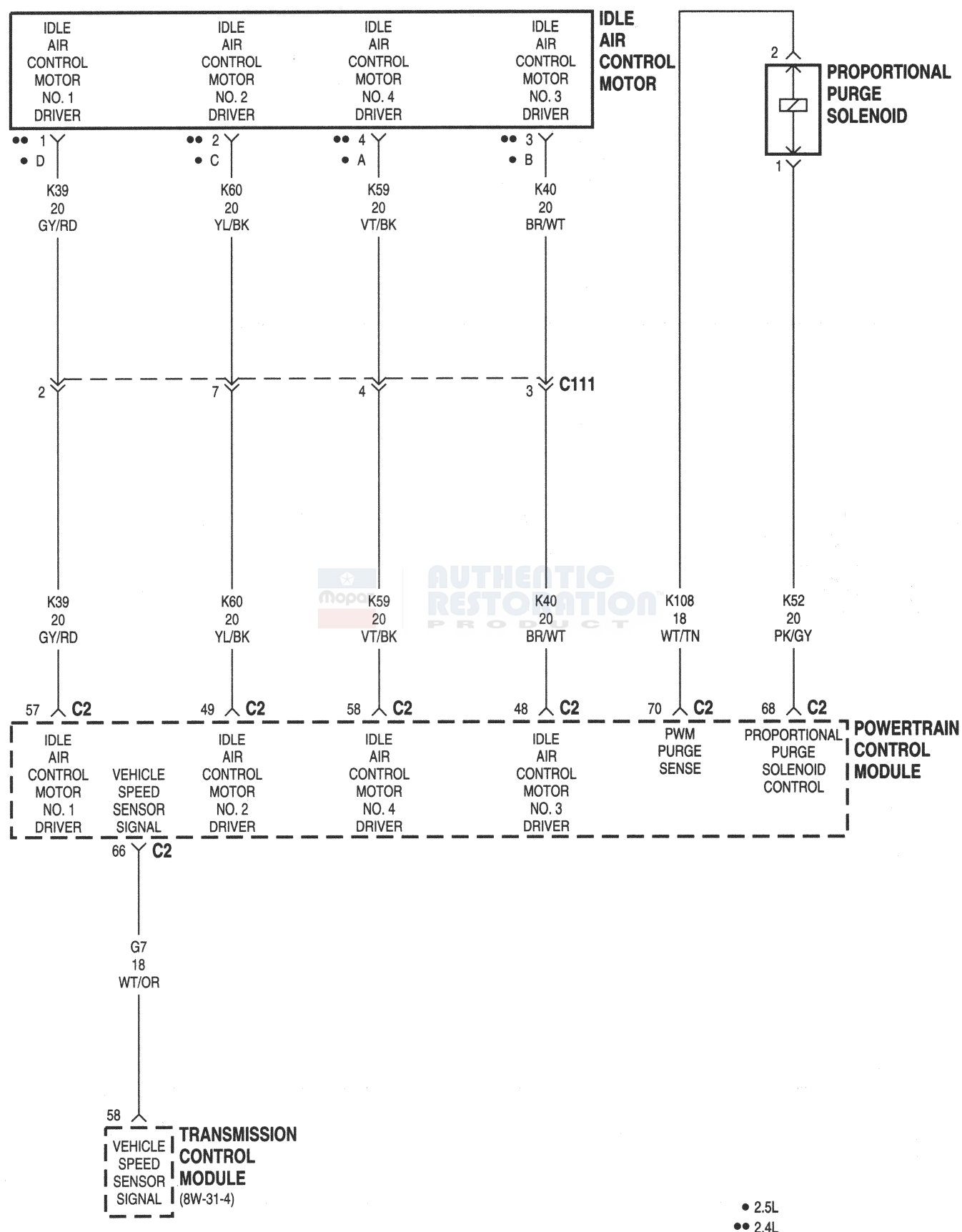


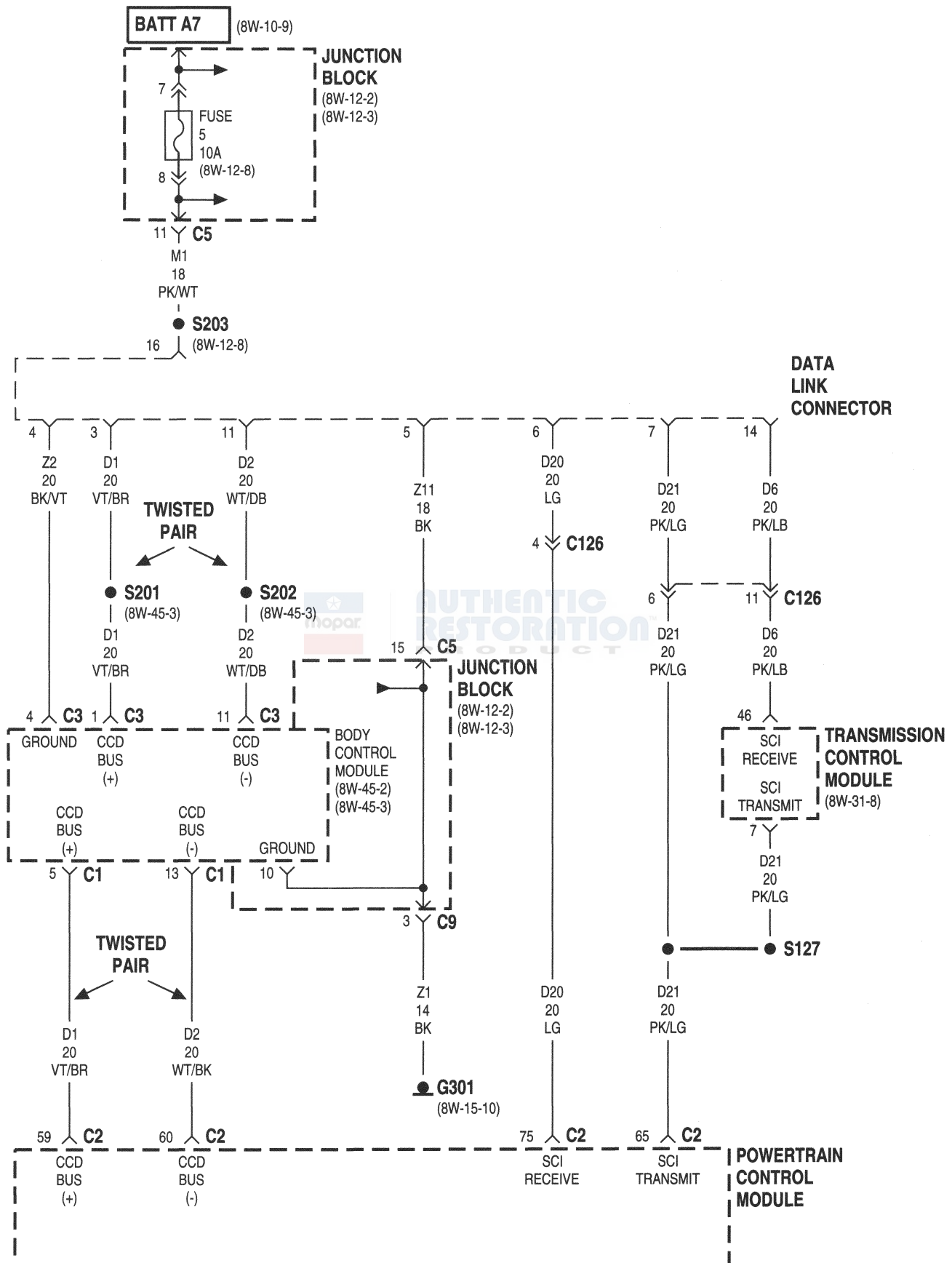












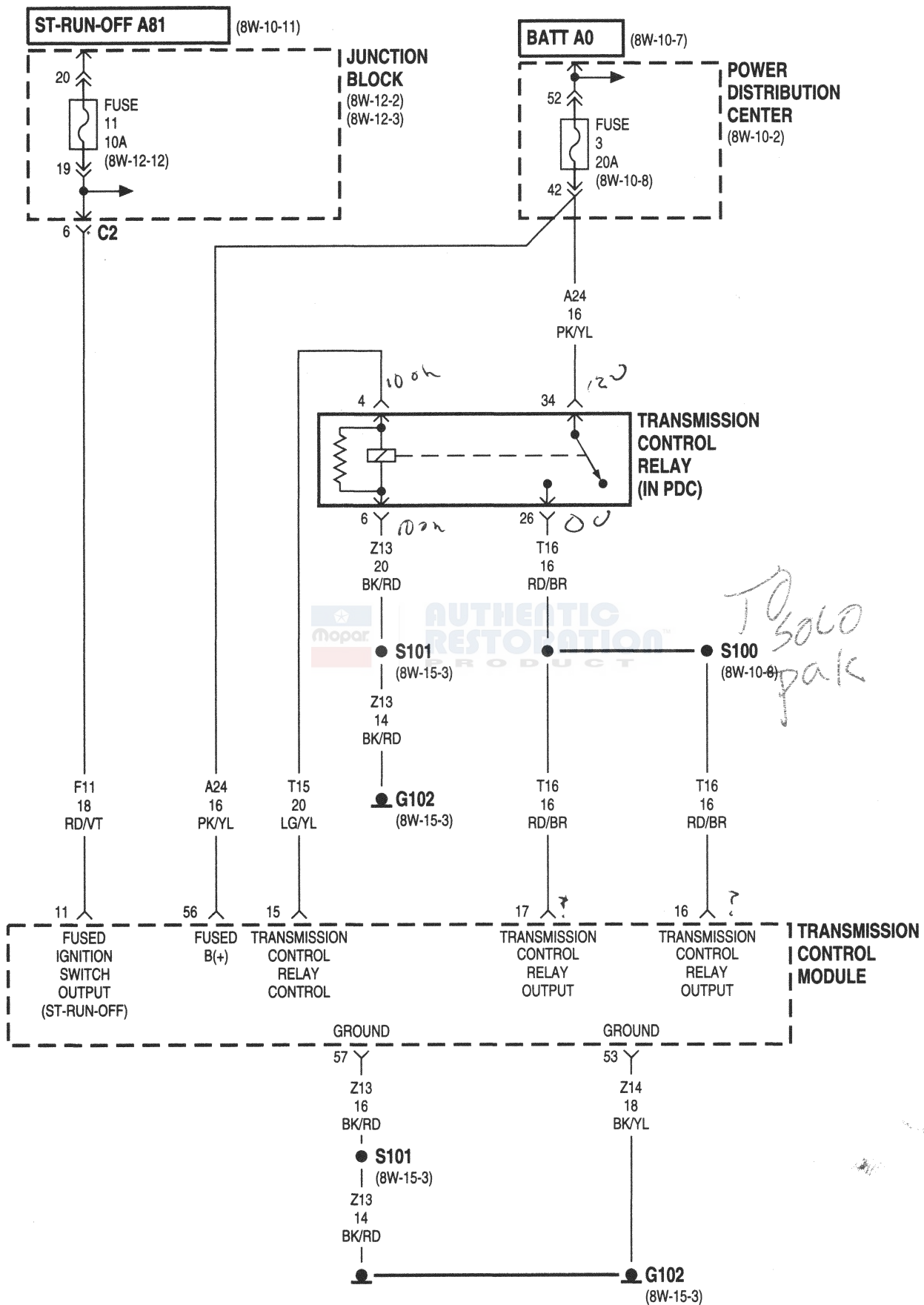
## **8W-31 TRANSMISSION CONTROL SYSTEM**

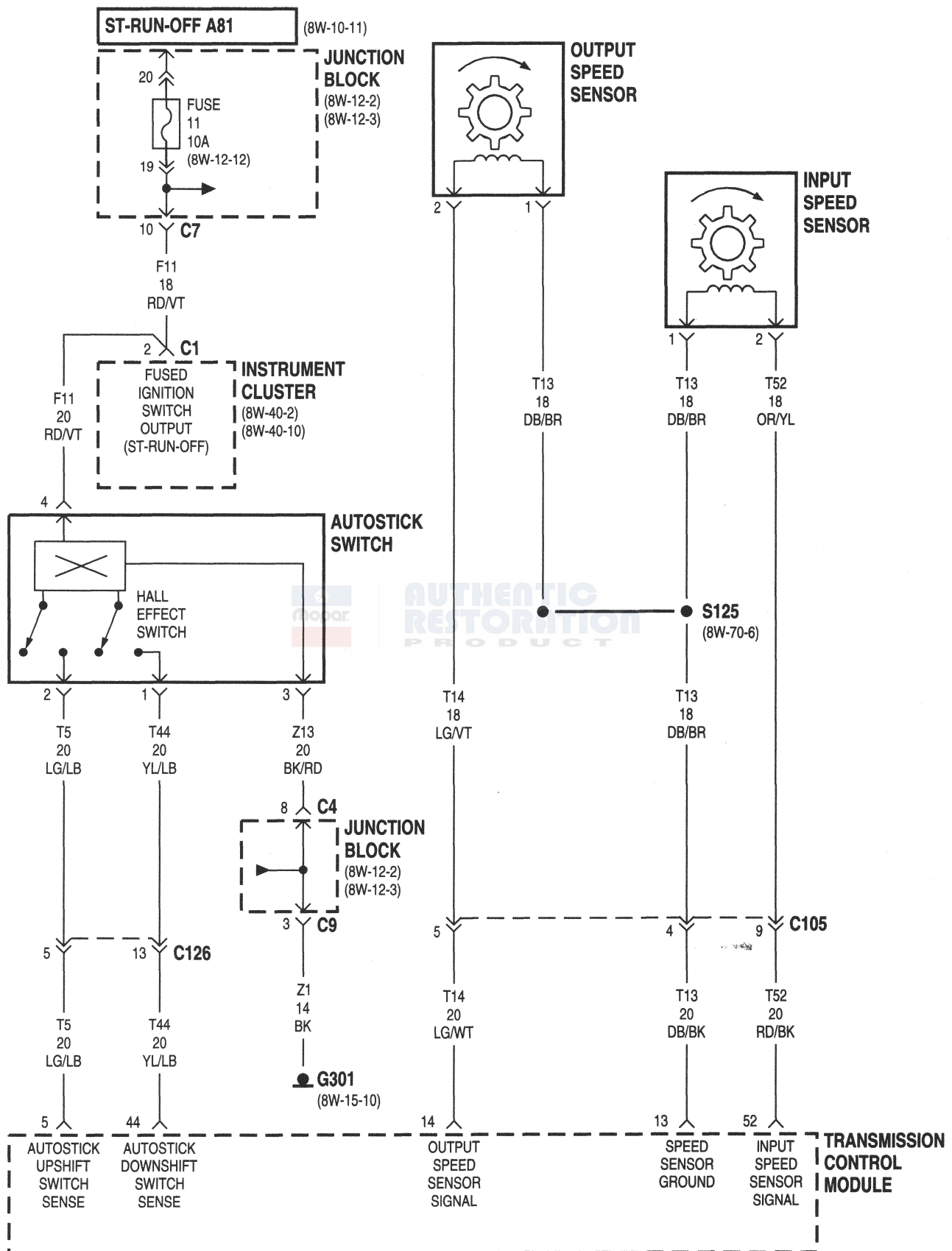
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Autostick Switch .....	8W-31-3	Low/Reverse Pressure Switch .....	8W-31-6
Body Control Module .....	8W-31-8	Low/Reverse Solenoid .....	8W-31-7
Crankshaft Position Sensor .....	8W-31-4	Output Speed Sensor .....	8W-31-3
Data Link Connector .....	8W-31-8	Overdrive Pressure Switch .....	8W-31-6
Engine Starter Motor Relay .....	8W-31-5	Overdrive Solenoid .....	8W-31-7
Fuse 3 (PDC) .....	8W-31-2	Power Distribution Center .....	8W-31-2, 6, 7
Fuse 4 (JB) .....	8W-31-5	Powertrain Control Module .....	8W-31-4, 5, 8
Fuse 11 (JB) .....	8W-31-2, 3	Throttle Position Sensor .....	8W-31-4
G102 .....	8W-31-2	Transmission Control Module .....	8W-31-2, 3, 4, 5, 6, 7, 8
G301 .....	8W-31-3	Transmission Control Relay .....	8W-31-2, 6, 7
Ignition Switch .....	8W-31-5	Transmission Range Sensor .....	8W-31-5
Input Speed Sensor .....	8W-31-3	Transmission Solenoid And Pressure Switch Assembly .....	8W-31-6,
Instrument Cluster .....	8W-31-3	Underdrive Solenoid .....	8W-31-7
Junction Block .....	8W-31-2, 3, 5		
Left Back-Up Lamp .....	8W-31-5		

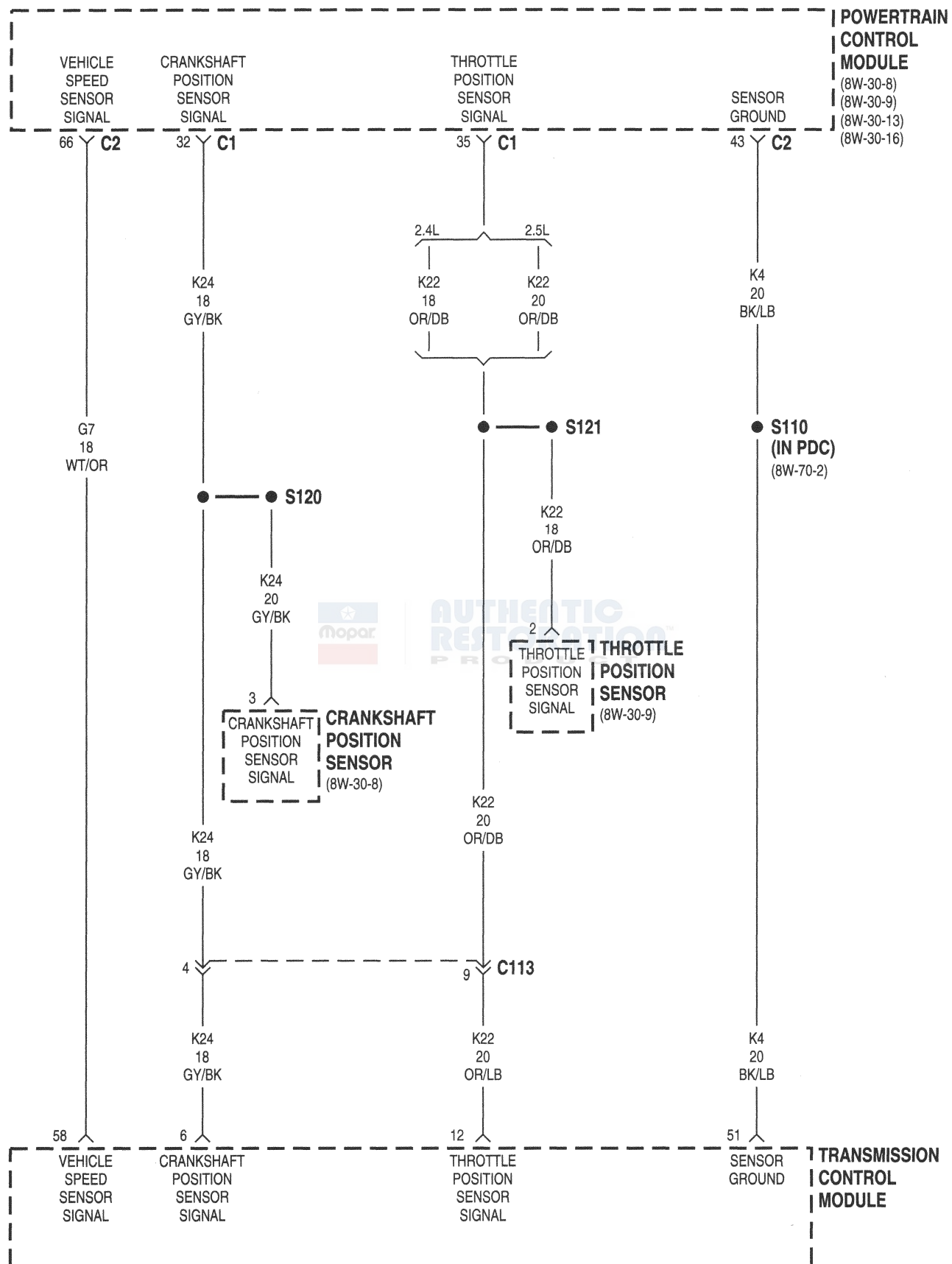


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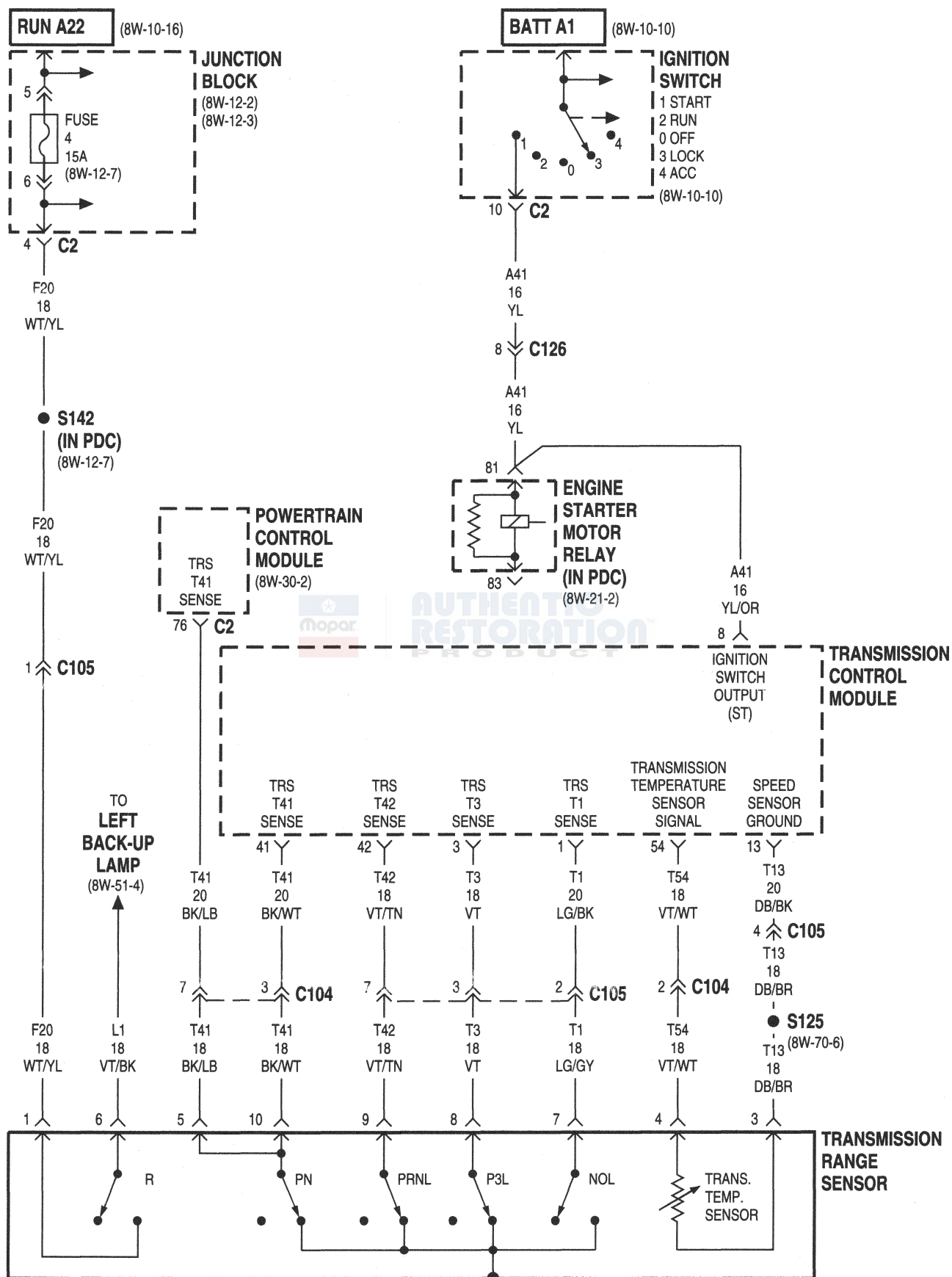


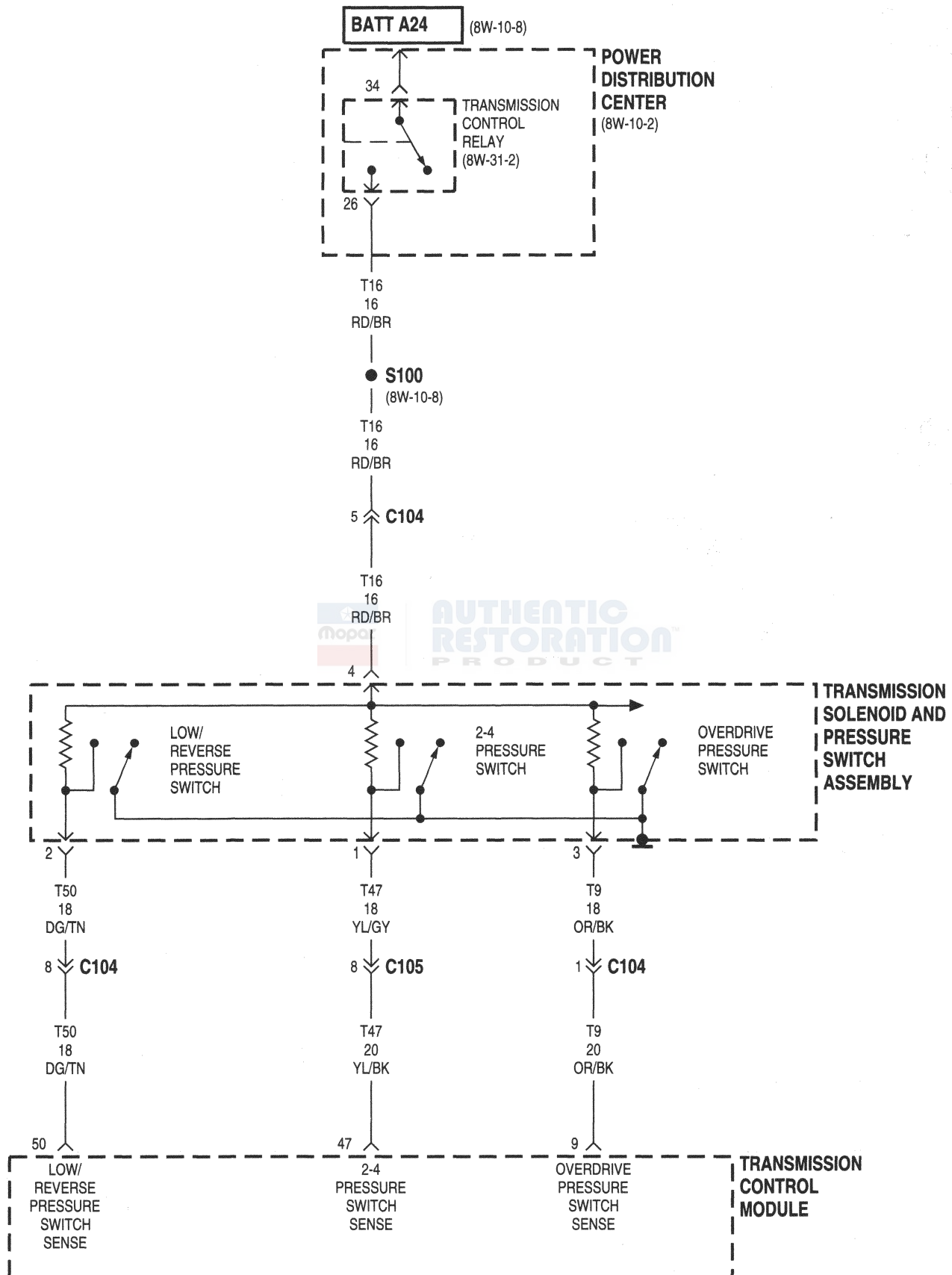


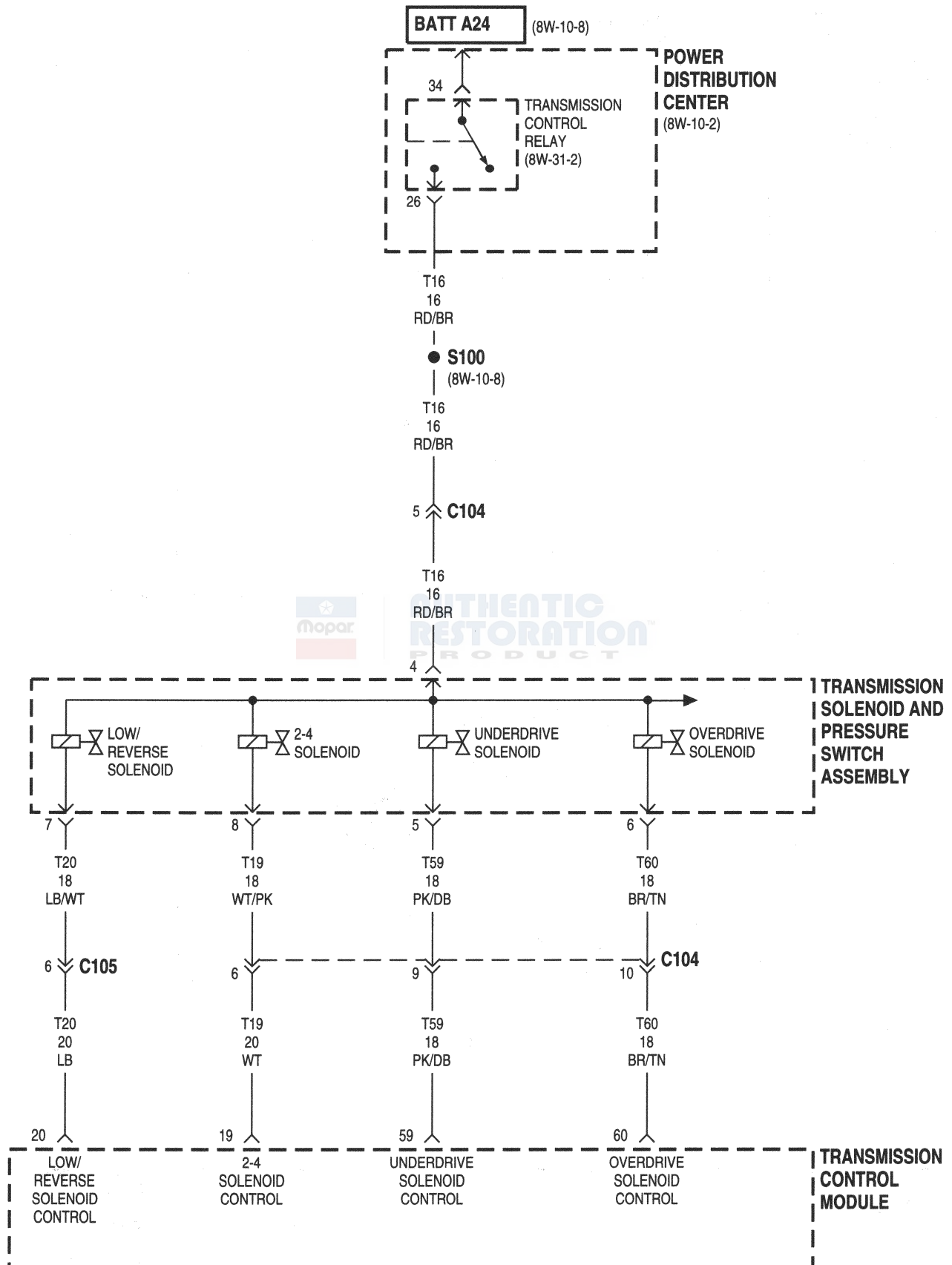




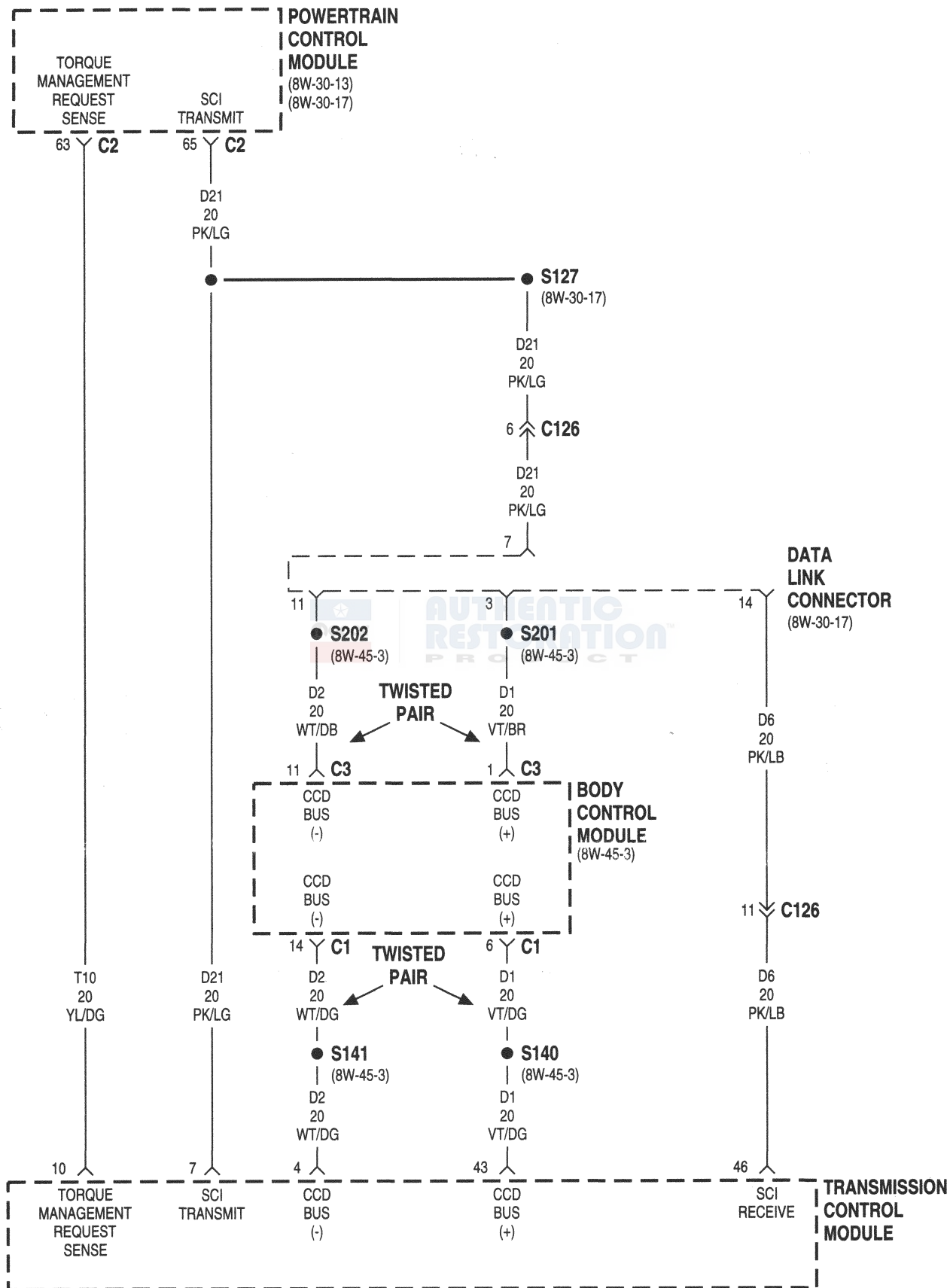










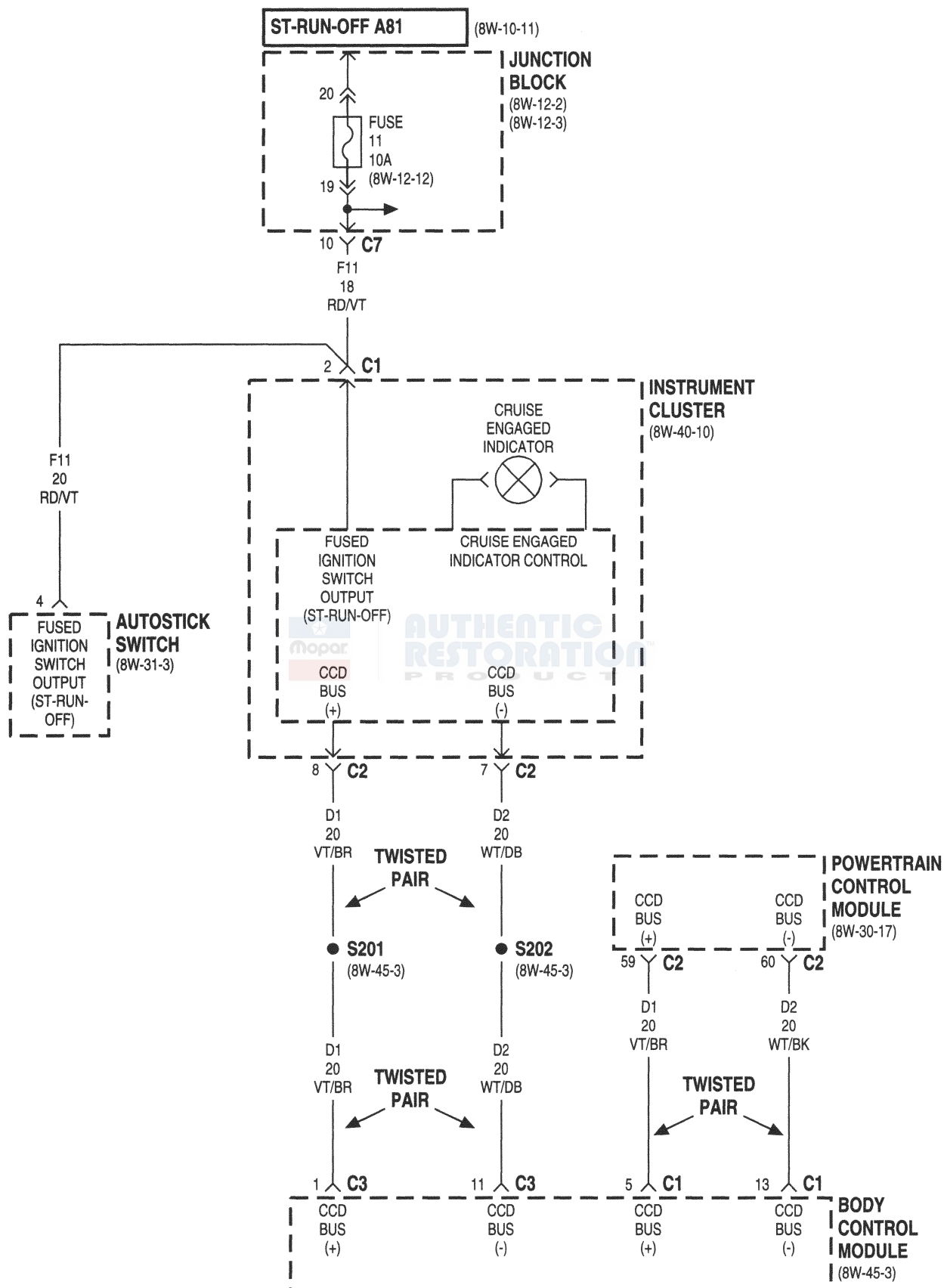


## **8W-33 VEHICLE SPEED CONTROL**

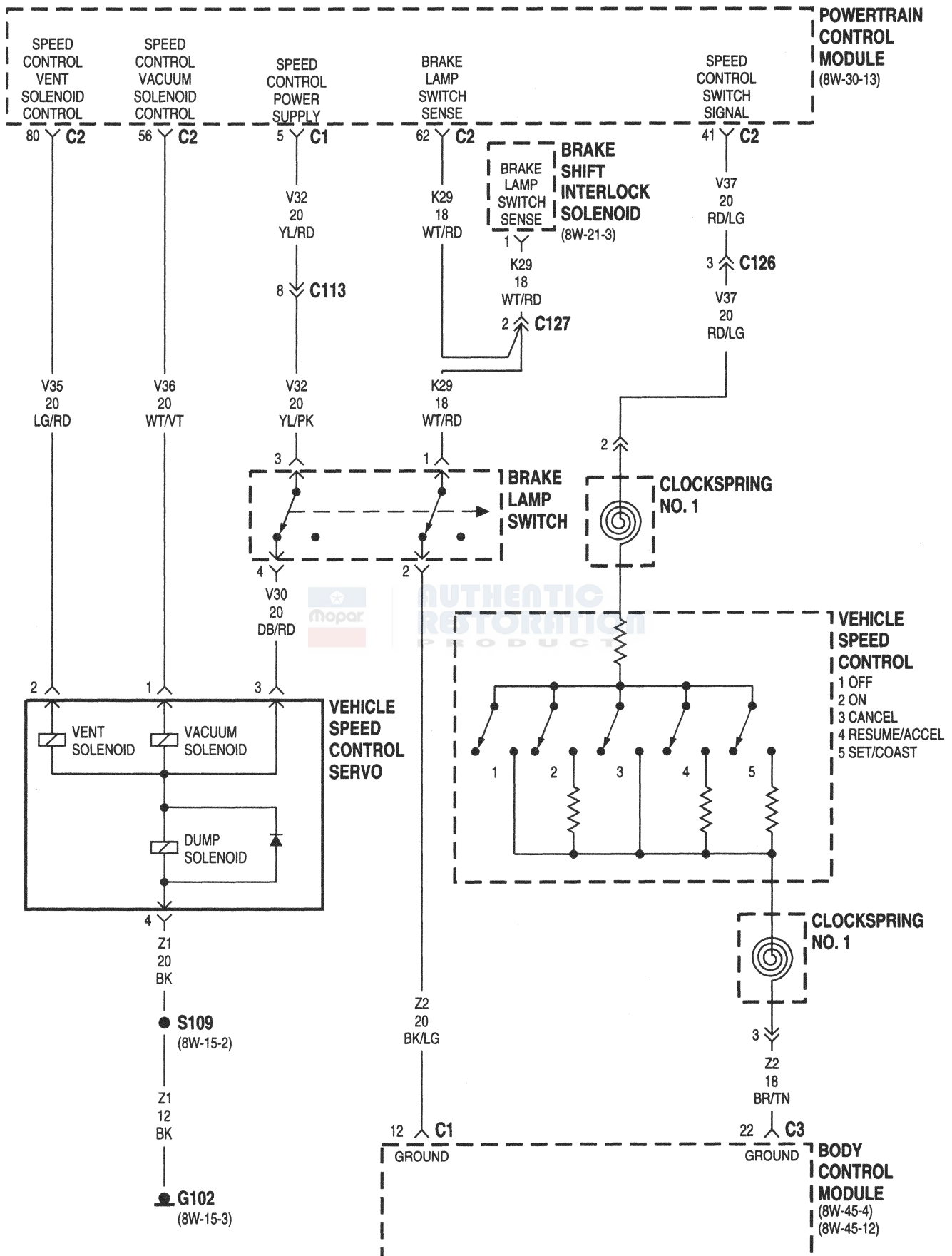
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Autostick Switch . . . . .	8W-33-2	G102 . . . . .	8W-33-3
Body Control Module . . . . .	8W-33-2, 3	Instrument Cluster . . . . .	8W-33-2
Brake Lamp Switch . . . . .	8W-33-3	Junction Block . . . . .	8W-33-2
Brake Shift Interlock Solenoid . . . . .	8W-33-3	Powertrain Control Module . . . . .	8W-33-2, 3
Clockspring No. 1 . . . . .	8W-33-3	Vehicle Speed Control . . . . .	8W-33-3
Cruise Engaged Indicator . . . . .	8W-33-2	Vehicle Speed Control Servo . . . . .	8W-33-3
Fuse 11 (JB) . . . . .	8W-33-2		



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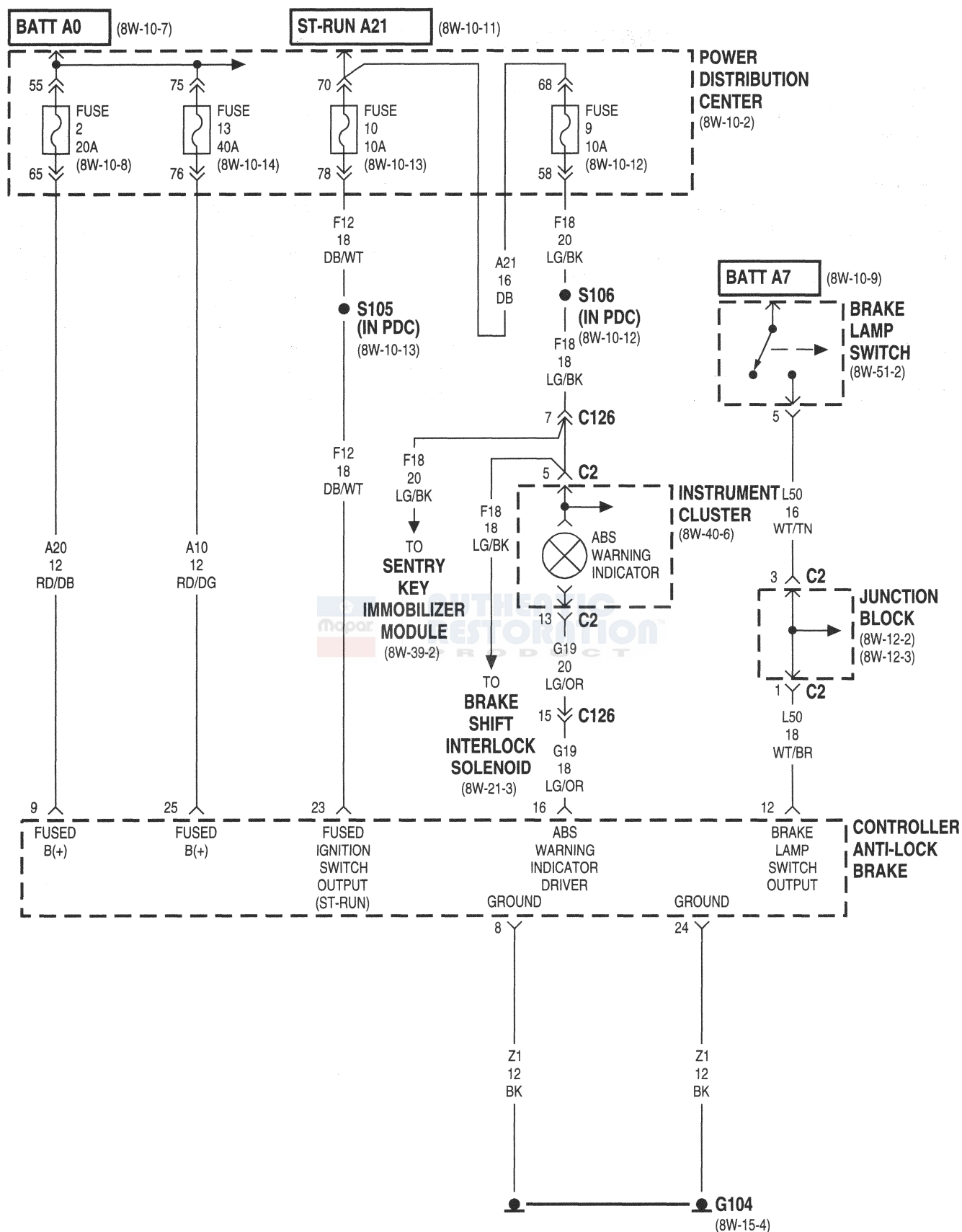


## **8W-35 ANTILOCK BRAKES**

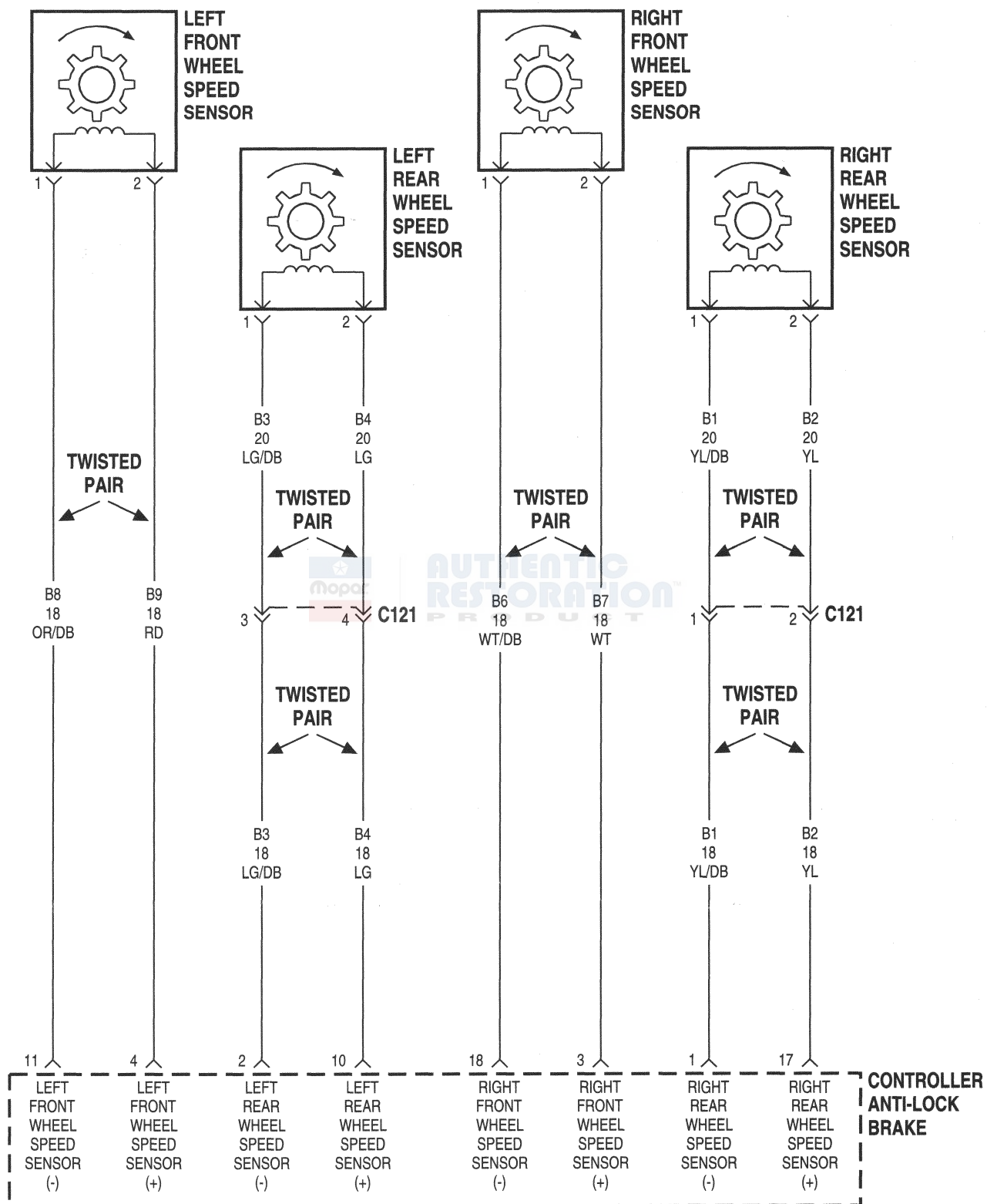
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
ABS Warning Indicator .....	8W-35-2	Headlamp Switch .....	8W-35-5
Autostick Switch .....	8W-35-6	Instrument Cluster .....	8W-35-2, 6
Body Control Module .....	8W-35-4, 5, 6	Junction Block .....	8W-35-2, 5, 6
Brake Lamp Switch .....	8W-35-2	Left Front Wheel Speed Sensor .....	8W-35-3
Brake Shift Interlock Solenoid .....	8W-35-2, 6	Left Rear Wheel Speed Sensor .....	8W-35-3
Controller Anti-Lock Brake .....	8W-35-2, 3, 4, 5, 6	Power Distribution Center .....	8W-35-2, 4, 6
Fuse 2 (PDC) .....	8W-35-2, 4	PRNDL Illumination LED .....	8W-35-5
Fuse 9 (PDC) .....	8W-35-2, 6	Right Front Wheel Speed Sensor .....	8W-35-3
Fuse 10 (PDC) .....	8W-35-2	Right Rear Wheel Speed Sensor .....	8W-35-3
Fuse 11 (JB) .....	8W-35-6	Sentry Key Immobilizer Module .....	8W-35-2, 6
Fuse 13 (PDC) .....	8W-35-2, 4	Traction Control Switch .....	8W-35-5
G104 .....	8W-35-2, 4	Traction Engaged Indicator .....	8W-35-6
G301 .....	8W-35-5	Traction Warning Indicator .....	8W-35-6

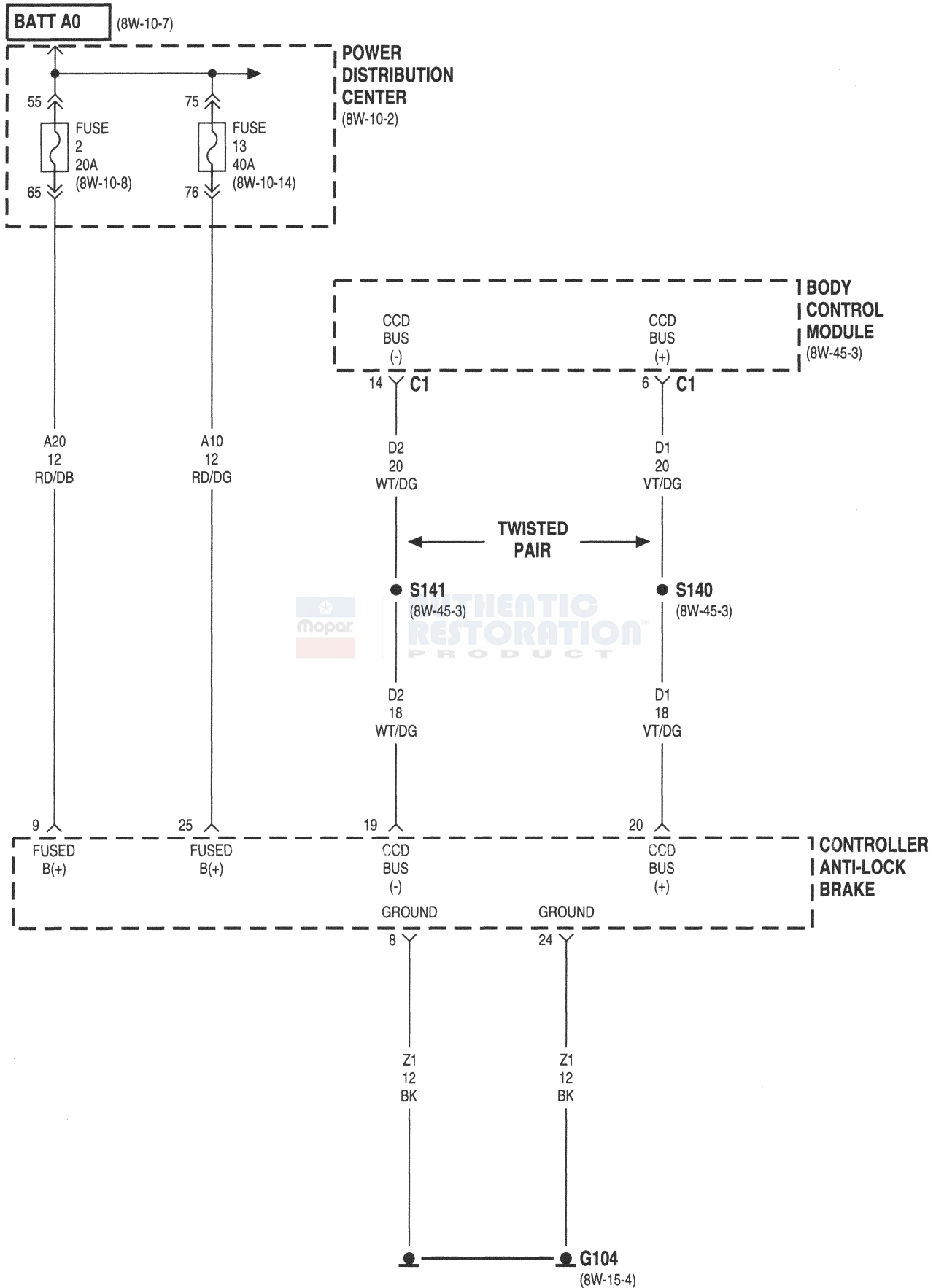


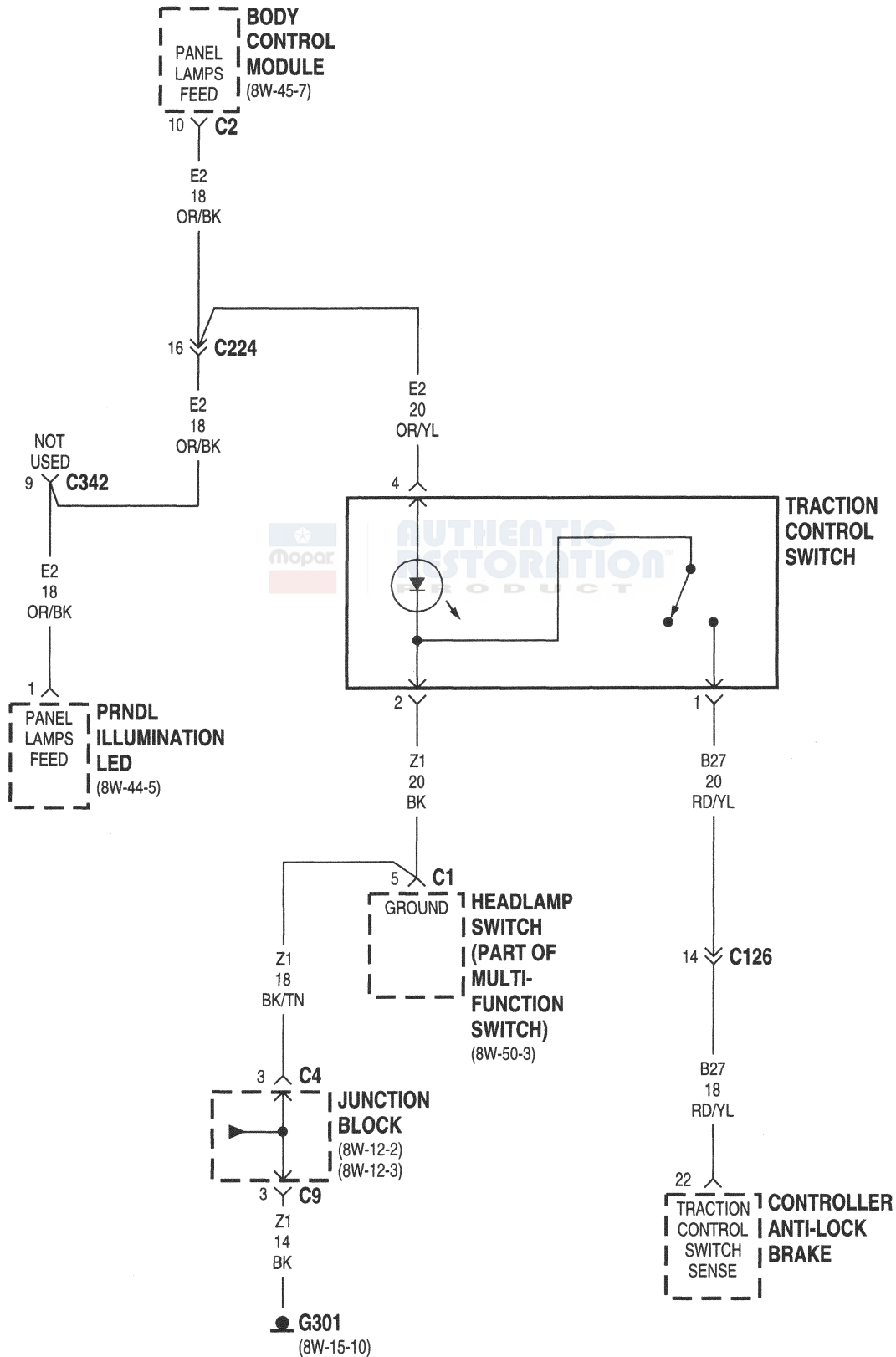
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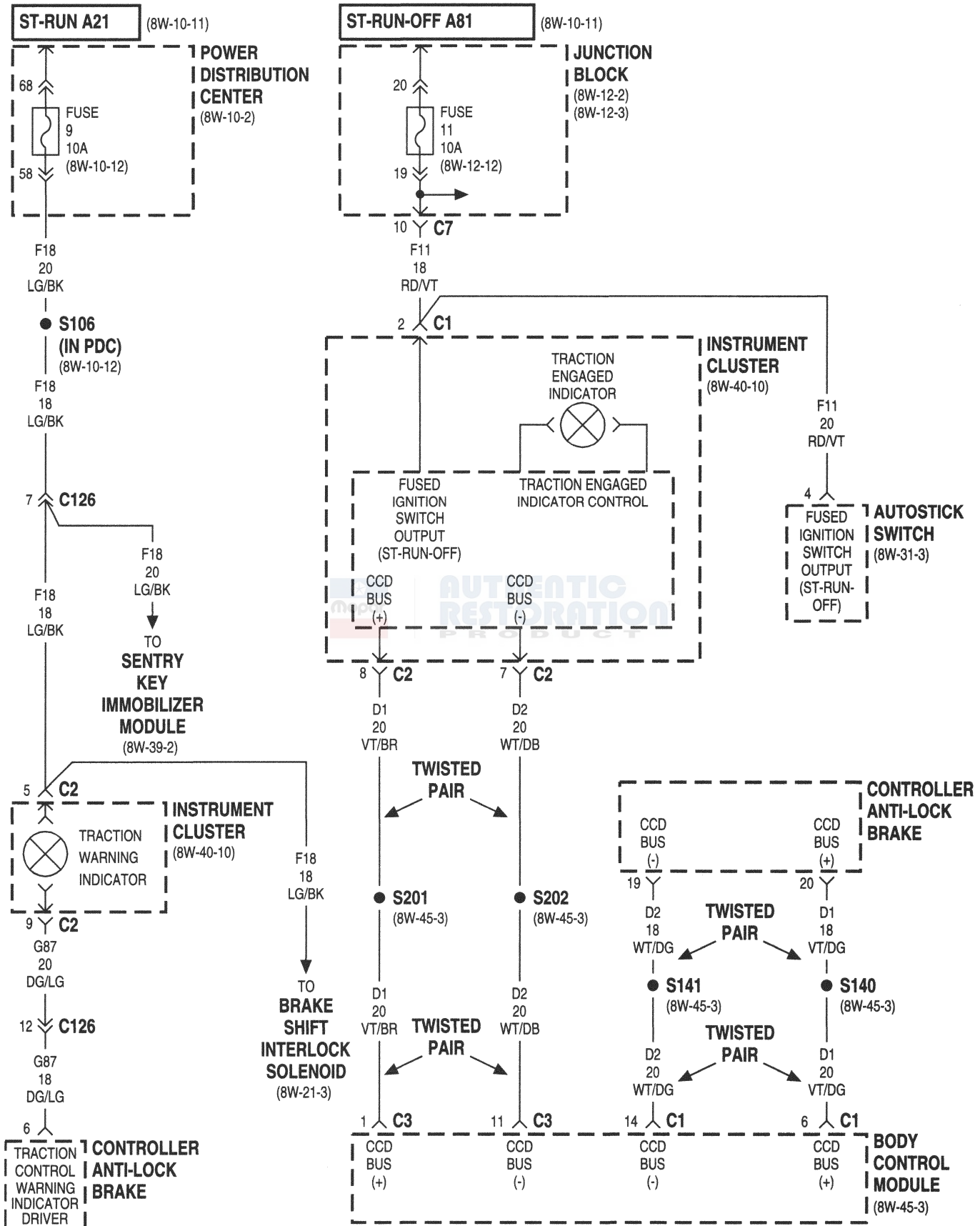










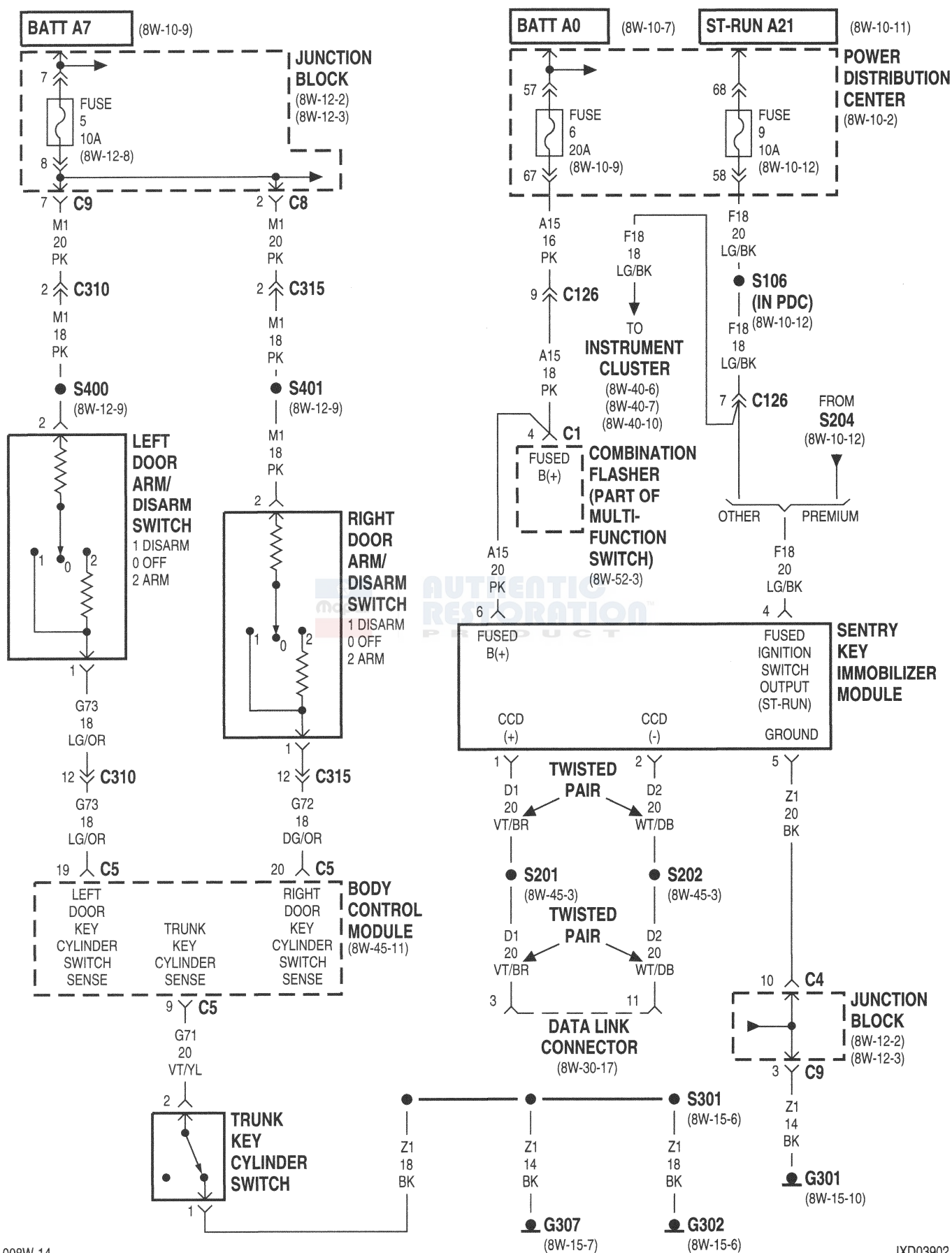


## **8W-39 VEHICLE THEFT SECURITY SYSTEM**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Body Control Module .....	8W-39-2, 3, 4	Junction Block .....	8W-39-2, 3, 4
Combination Flasher .....	8W-39-2	Left Door Ajar Switch .....	8W-39-3
Data Link Connector .....	8W-39-2	Left Door Arm/Disarm Switch .....	8W-39-2
Fuse 5 (JB) .....	8W-39-2	Left Park/Turn Signal Lamp .....	8W-39-4
Fuse 6 (PDC) .....	8W-39-2	Power Distribution Center .....	8W-39-2
Fuse 7 (JB) .....	8W-39-3	Powertrain Control Module .....	8W-39-3
Fuse 8 (JB) .....	8W-39-4	Right Door Ajar Switch .....	8W-39-3
Fuse 9 (PDC) .....	8W-39-2	Right Door Arm/Disarm Switch .....	8W-39-2
G301 .....	8W-39-2	Right Park/Turn Signal Lamp .....	8W-39-4
G302 .....	8W-39-2	Seat Belt Control Module .....	8W-39-3
G307 .....	8W-39-2	Sentry Key Immobilizer Module .....	8W-39-2
Headlamp Delay Relay .....	8W-39-4	Trunk Ajar Switch .....	8W-39-3
Horn Relay .....	8W-39-4	Trunk Key Cylinder Switch .....	8W-39-2
Illuminated Entry Relay .....	8W-39-4	Trunk Lamp .....	8W-39-3
Instrument Cluster .....	8W-39-2, 3	VTSS Set LED .....	8W-39-3

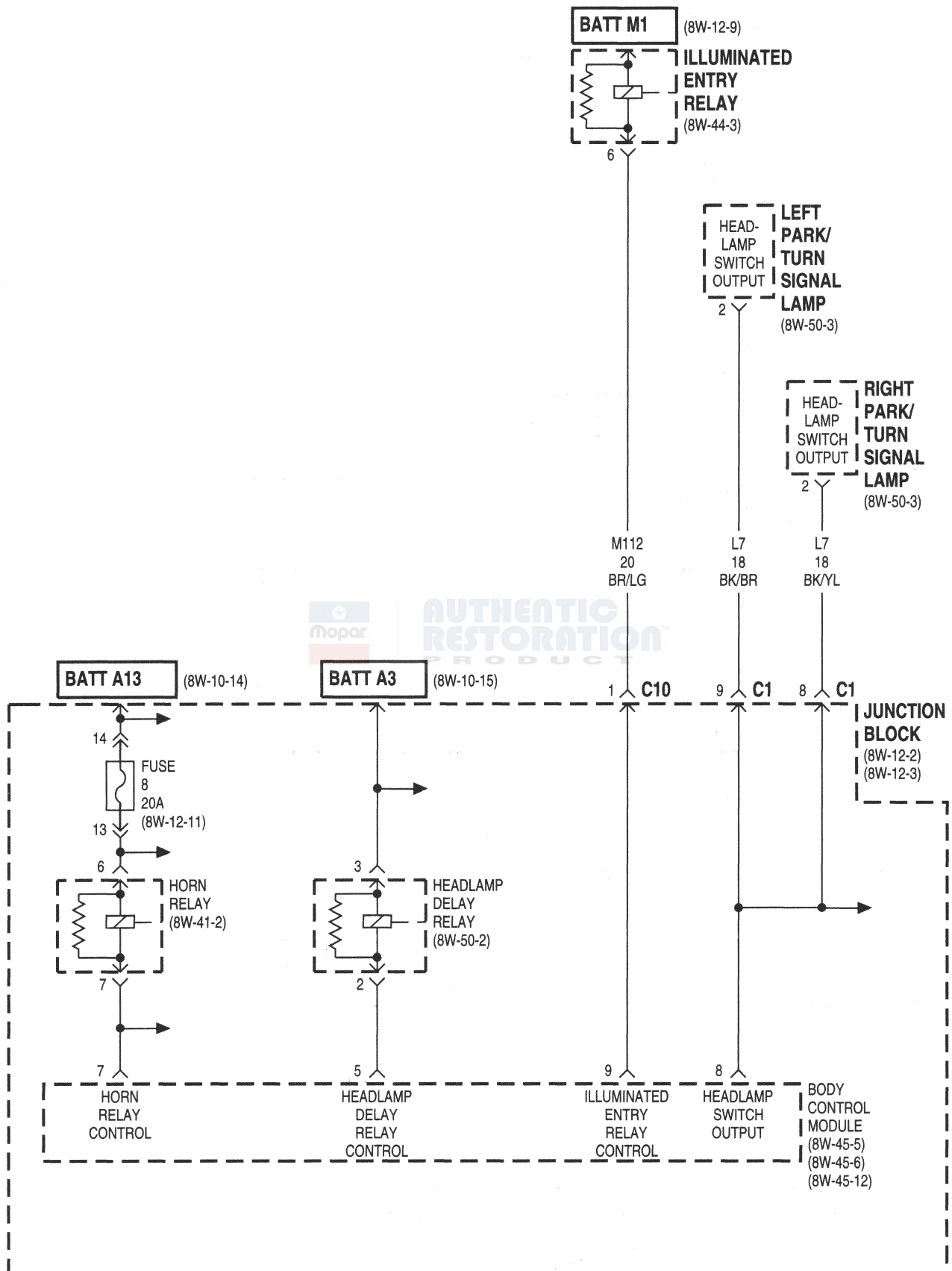


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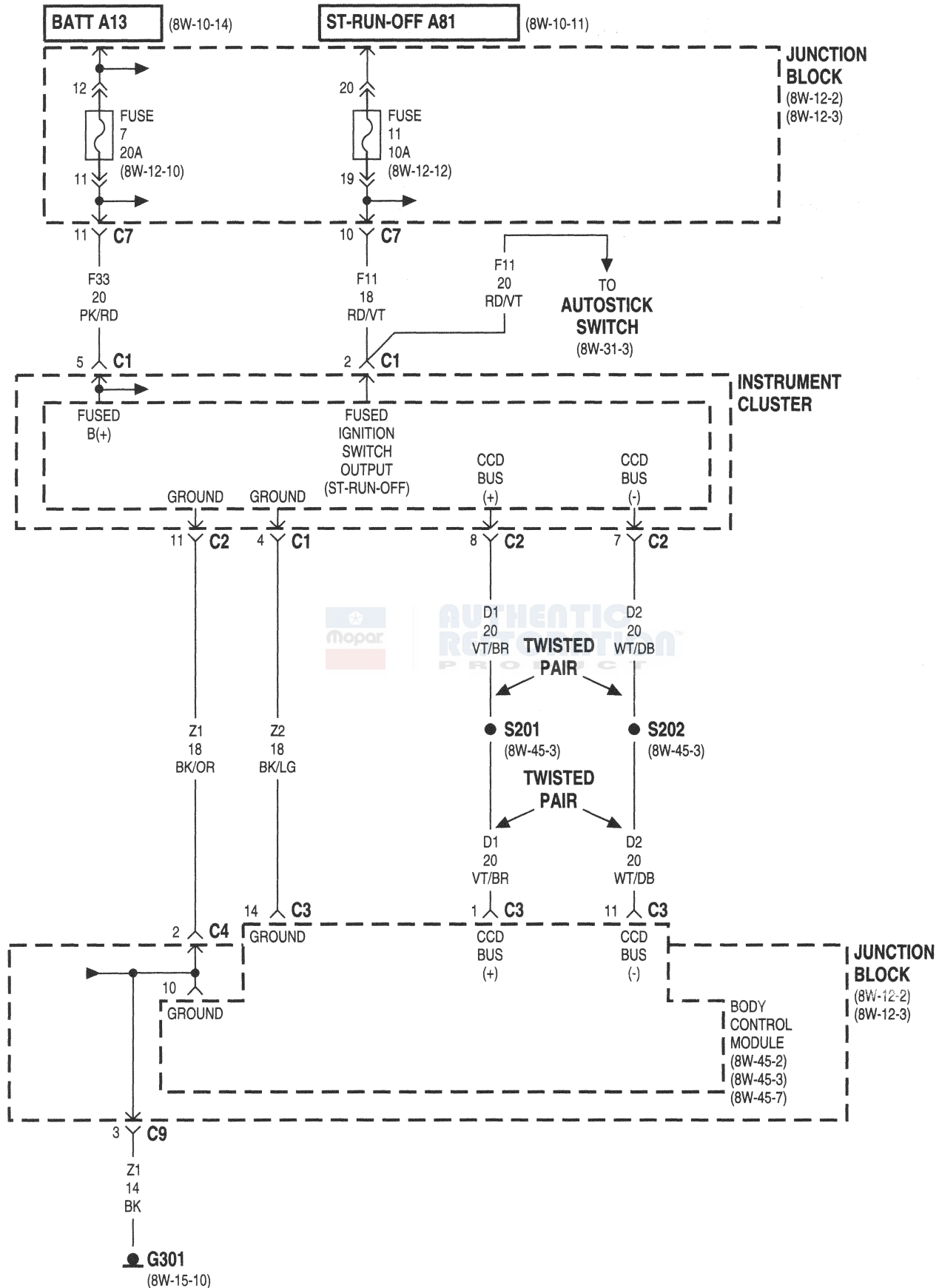


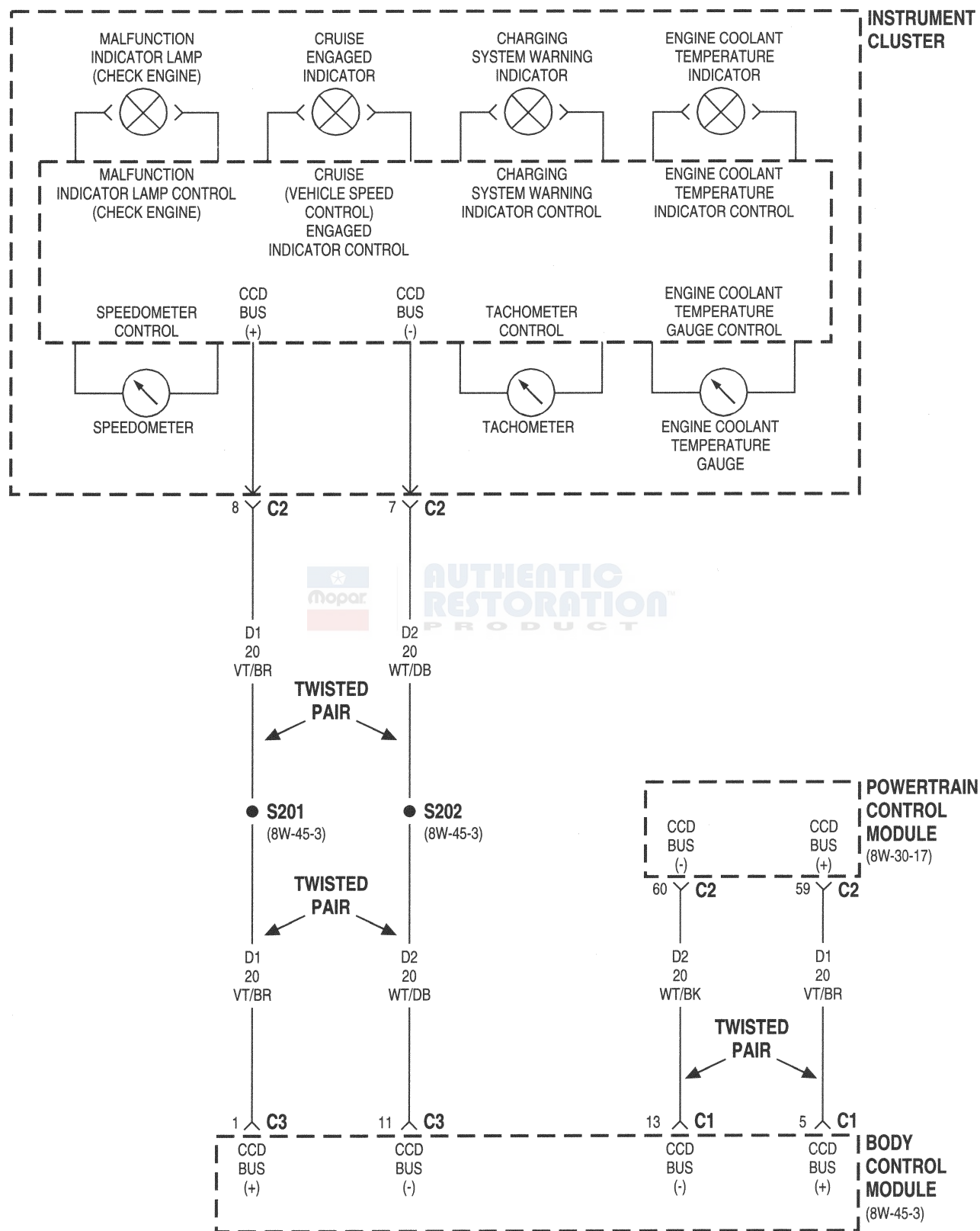
## 8W-40 INSTRUMENT CLUSTER

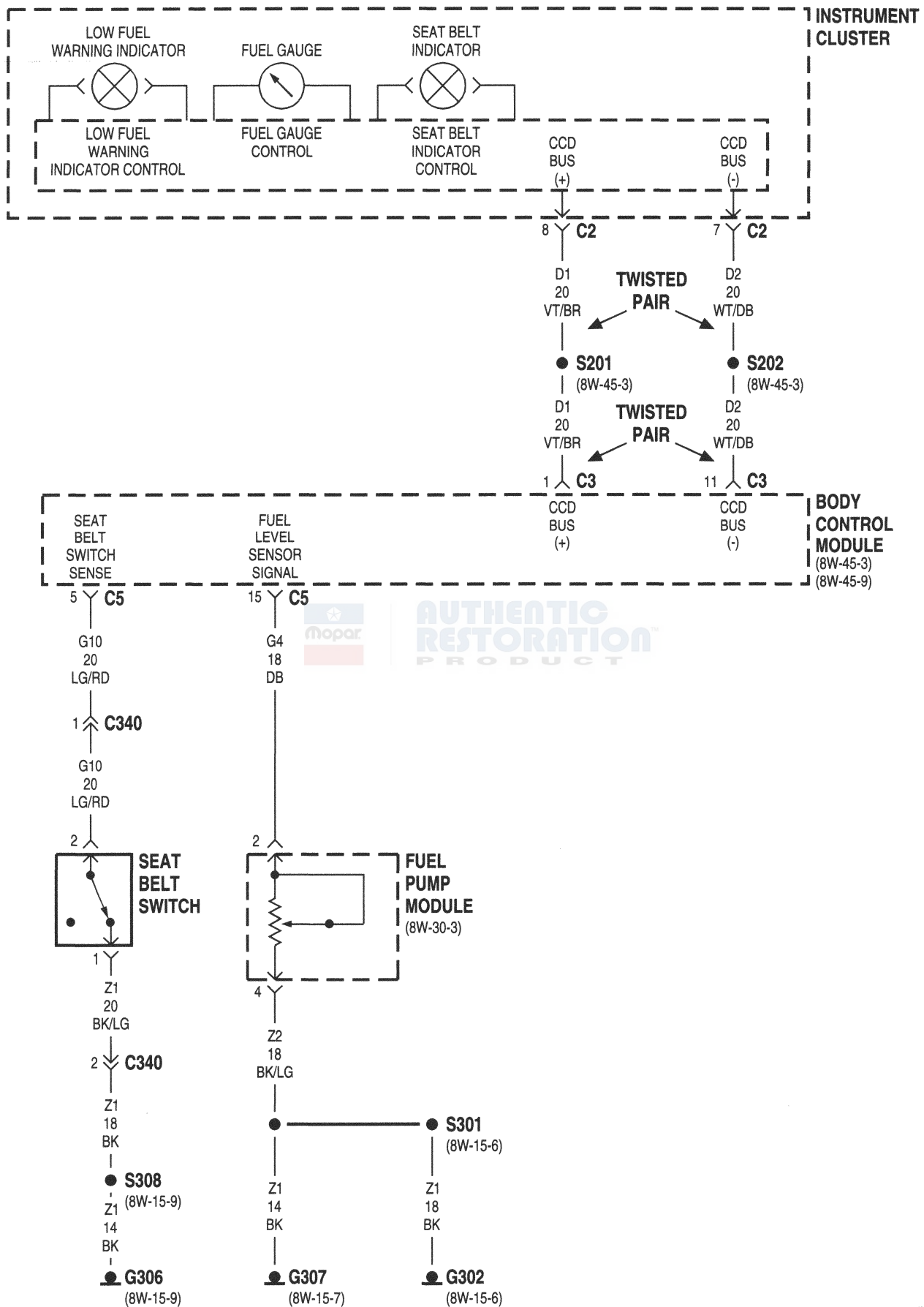
Component	Page
ABS Warning Indicator .....	8W-40-6
Airbag Control Module .....	8W-40-5
Airbag Warning Indicator .....	8W-40-5
Autostick Switch .....	8W-40-2, 10
Body Control Module .....	8W-40-2, 3, 4, 5, 6, 8, 10
Brake Fluid Level Switch .....	8W-40-7
Brake Shift Interlock Solenoid .....	8W-40-6, 7, 10
Brake Warning Indicator .....	8W-40-7
Charging System Warning Indicator .....	8W-40-3
Cluster Illumination Lamps .....	8W-40-8
Controller Anti-Lock Brake .....	8W-40-6, 10
Cruise Engaged Indicator .....	8W-40-3
Daytime Running Lamp Module .....	8W-40-7
Decklid Ajar Indicator .....	8W-40-5
Door Ajar Indicator .....	8W-40-5
Engine Coolant Temperature .....	8W-40-3
Engine Coolant Temperature Indicator .....	8W-40-3
Fog Lamp Indicator .....	8W-40-8
Fog Lamp Switch .....	8W-40-8
Fuel Gauge .....	8W-40-4
Fuel Pump Module .....	8W-40-4
Fuse 7 (JB) .....	8W-40-2, 6
Fuse 9 (PDC) .....	8W-40-6, 7, 10
Fuse 11 (JB) .....	8W-40-2, 10
G102 .....	8W-40-7
G103 .....	8W-40-9
G301 .....	8W-40-2, 7, 8
G302 .....	8W-40-4
G306 .....	8W-40-4

Component	Page
G307 .....	8W-40-4
High Beam Indicator .....	8W-40-5
Ignition Switch .....	8W-40-7
Instrument Cluster ...	8W-40-2, 3, 4, 5, 6, 7, 8, 9, 10
Junction Block .....	8W-40-2, 6, 7, 8, 10
Left Turn Signal Indicator .....	8W-40-8
Low Washer Fluid Level Indicator .....	8W-40-9
Malfunction Indicator Lamp (Check Engine) .....	8W-40-3
Odometer/Trip .....	8W-40-5
Oil Pressure Indicator .....	8W-40-6
Oil Pressure Switch .....	8W-40-6
Park Brake Switch .....	8W-40-7
Power Distribution Center .....	8W-40-6, 7, 10
Powertrain Control Module .....	8W-40-3, 5
PRNDL/Autostick Indicator .....	8W-40-5
Right Turn Signal Indicator .....	8W-40-8
Seat Belt Indicator .....	8W-40-4
Seat Belt Switch .....	8W-40-4
Sentry Key Immobilizer Module ....	8W-40-6, 7, 10
Speedometer .....	8W-40-3
Tachometer .....	8W-40-3
Traction Engaged Indicator .....	8W-40-10
Traction Warning Indicator .....	8W-40-10
Transmission Control Module .....	8W-40-5
Traveler .....	8W-40-6, 7
Turn Signal/Hazard Warning Switch .....	8W-40-8
VTSS Set LED .....	8W-40-6
Washer Fluid Level Switch .....	8W-40-9

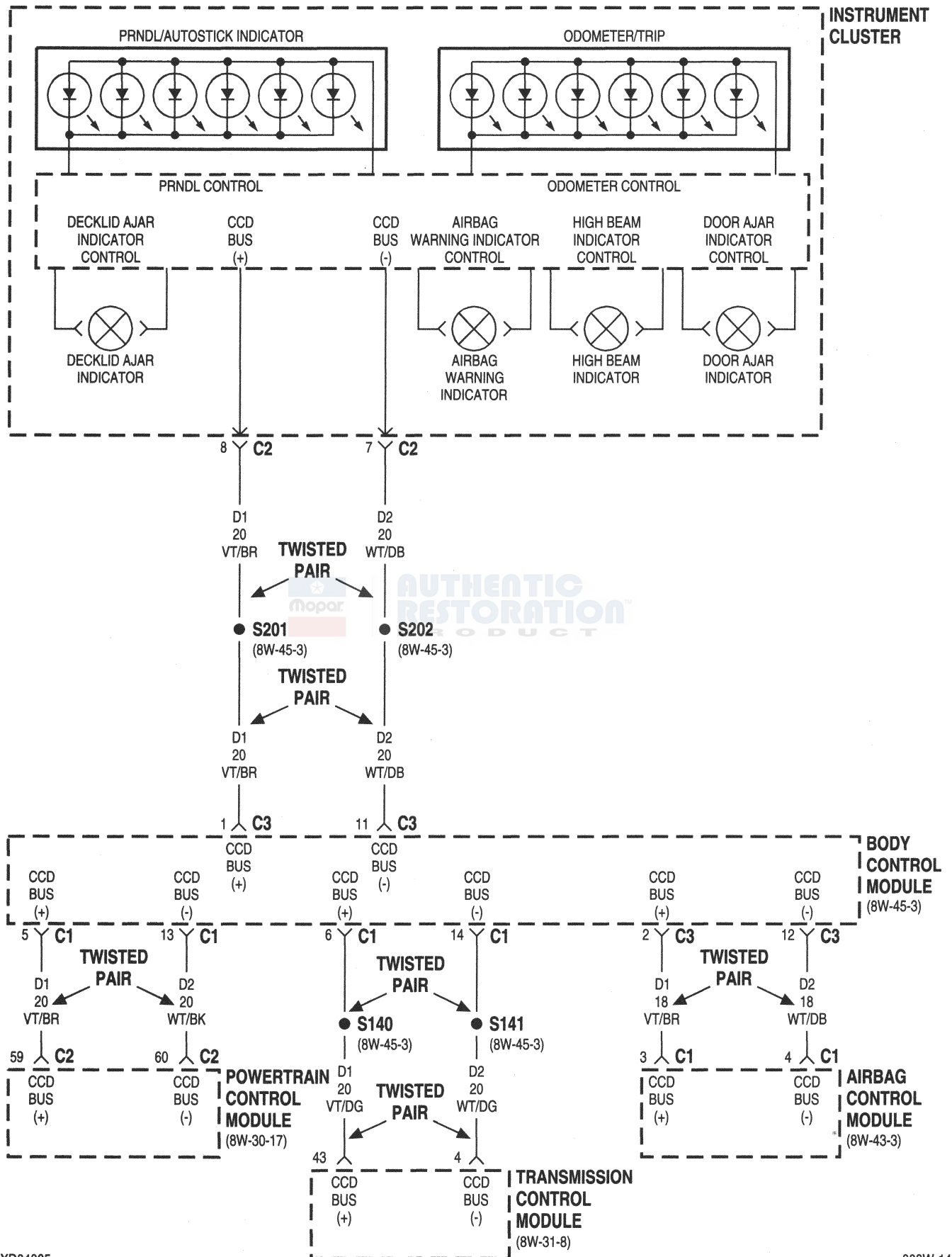


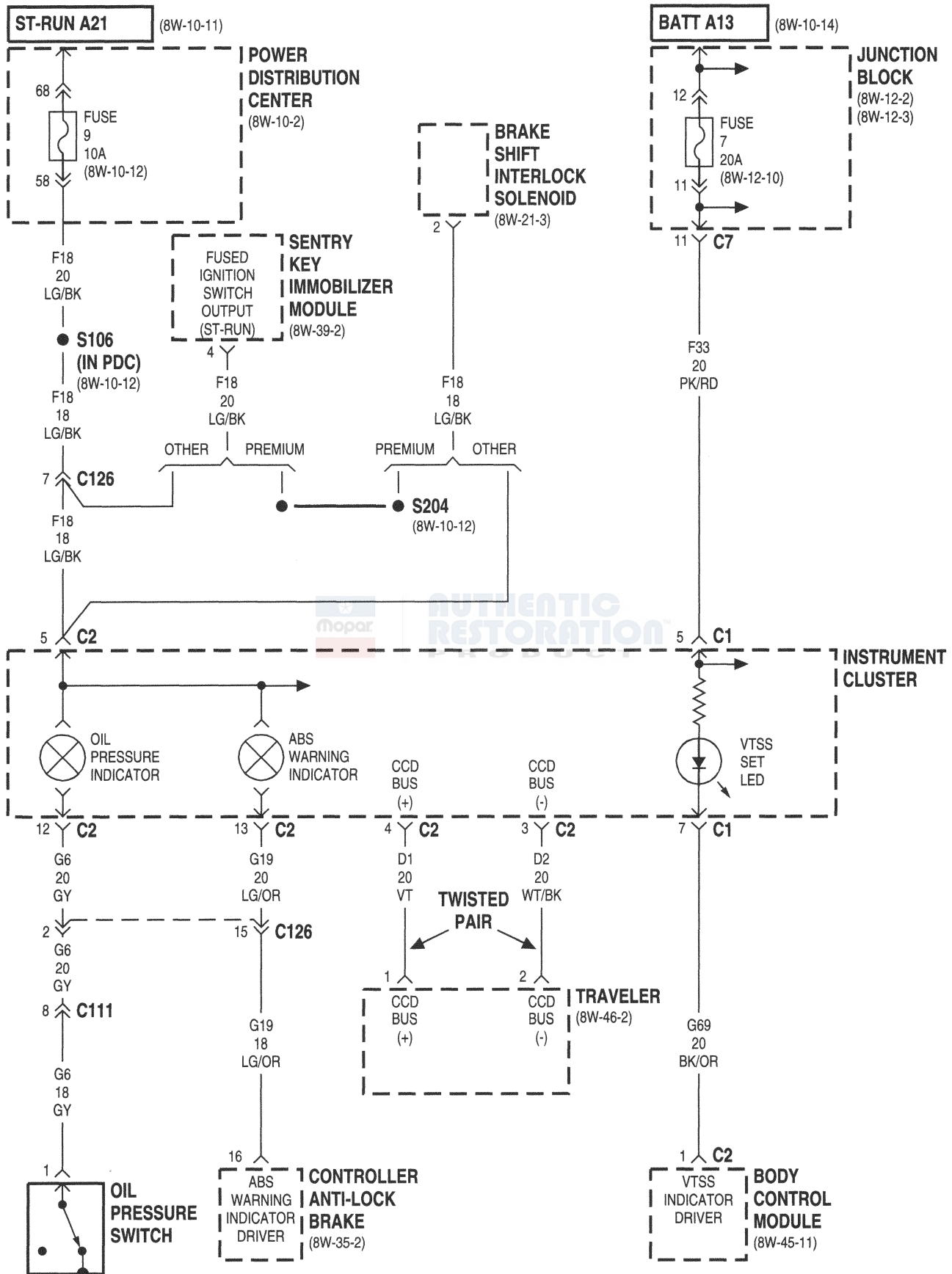


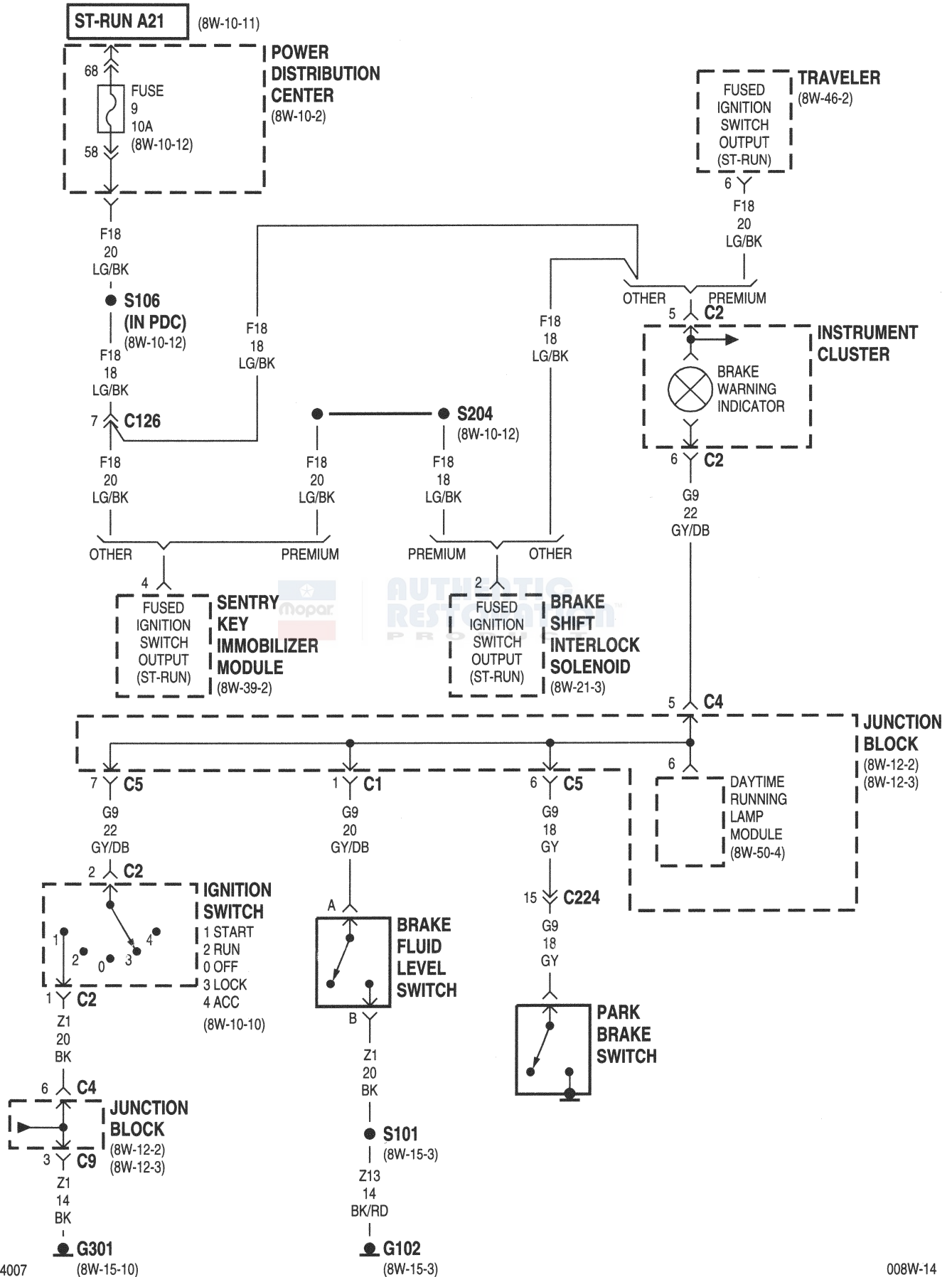




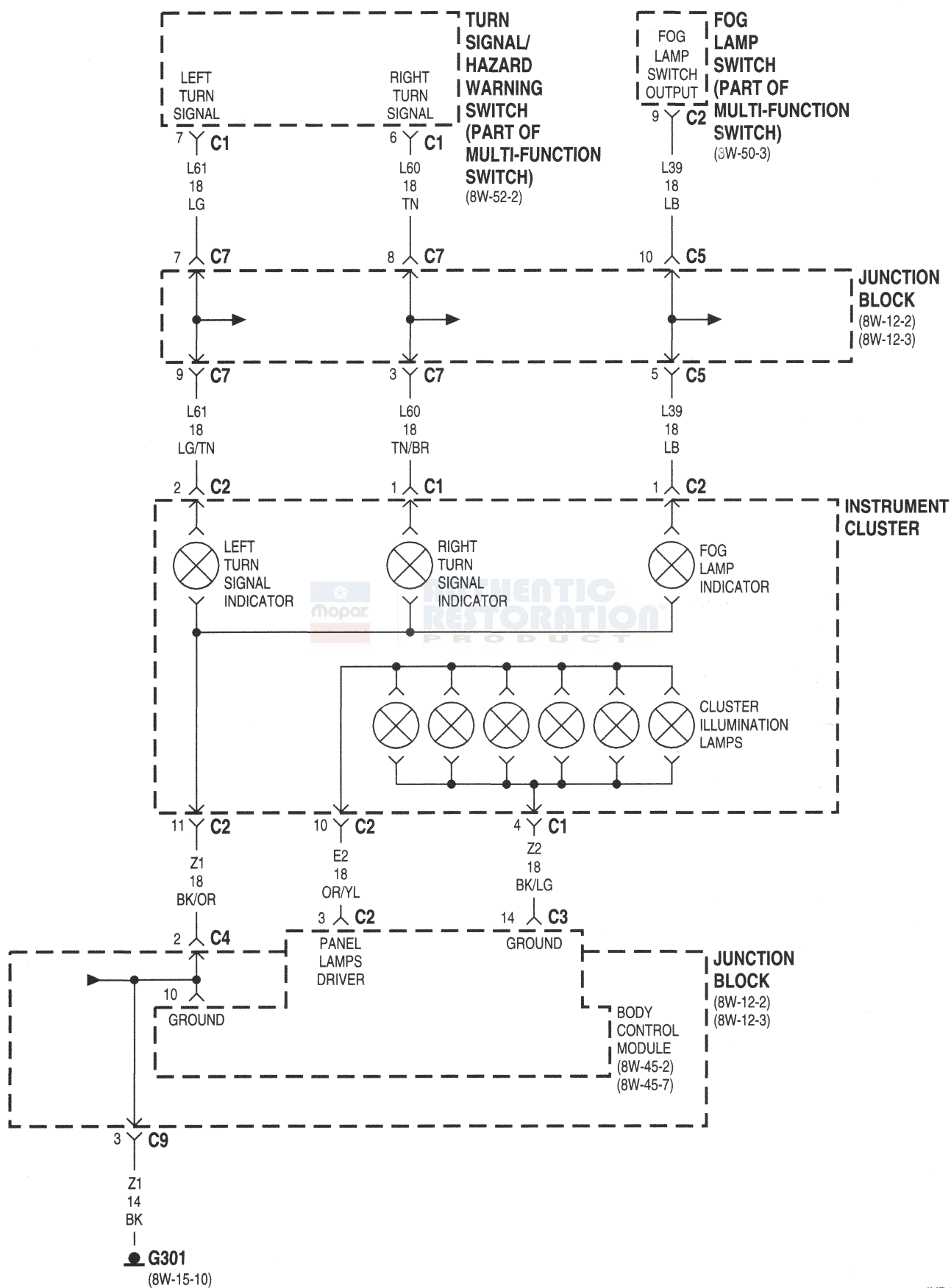


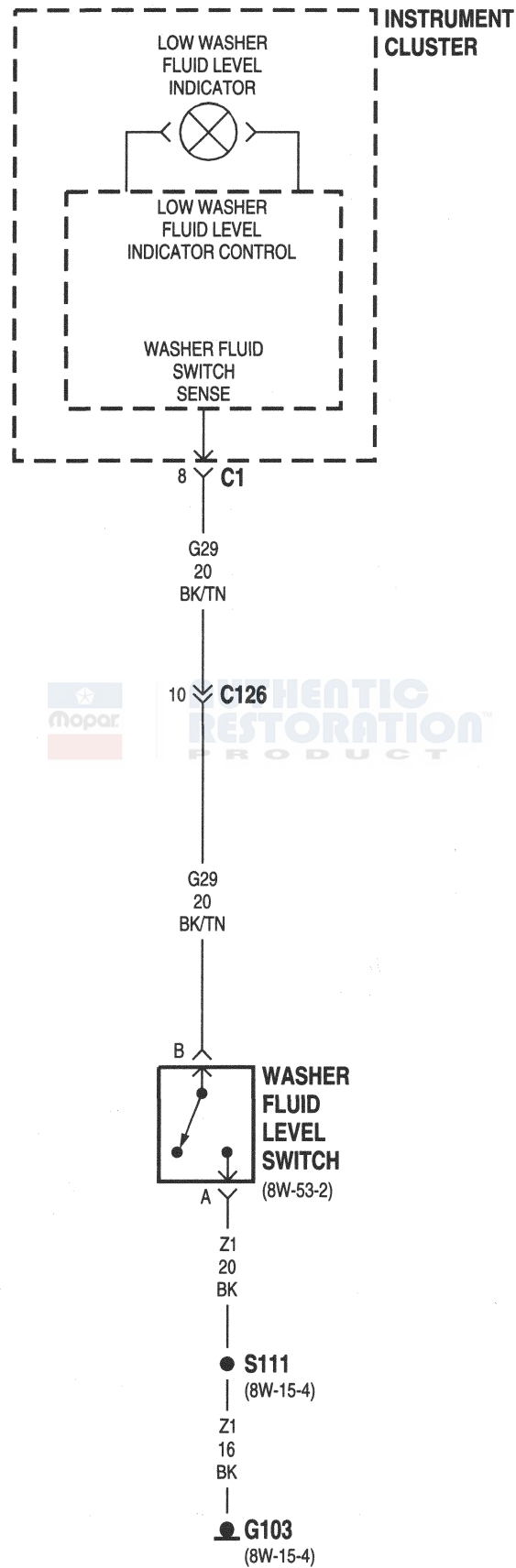


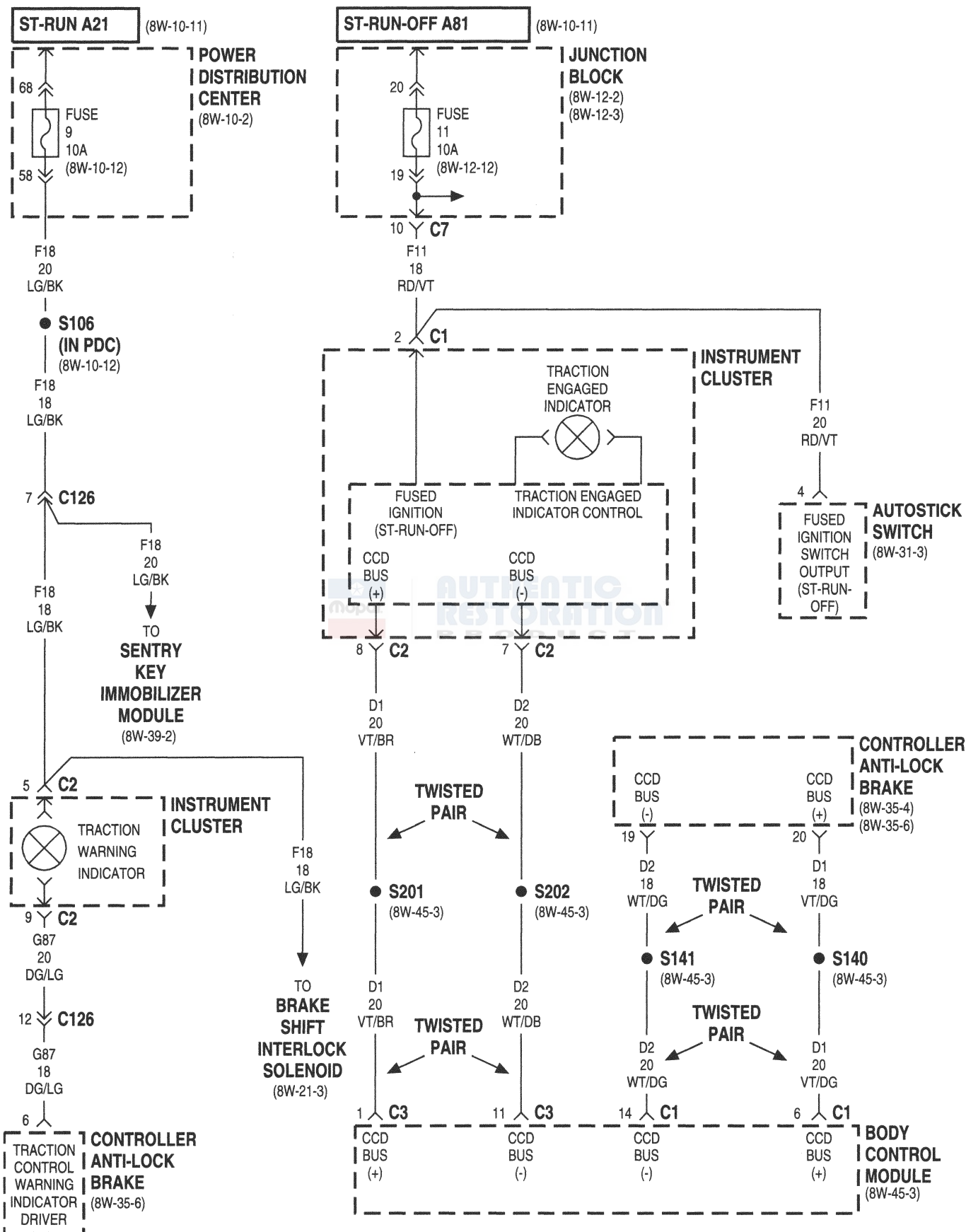














## **8W-41 HORN/CIGAR LIGHTER/POWER OUTLET**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Body Control Module . . . . .	8W-41-2	Horn Relay . . . . .	8W-41-2
Cigar Lighter/Power Outlet . . . . .	8W-41-2	Horn Switches . . . . .	8W-41-2
Clockspring No. 1 . . . . .	8W-41-2	Junction Block . . . . .	8W-41-2
Fuse 8 (JB) . . . . .	8W-41-2	Left Horn Switch . . . . .	8W-41-2
G103 . . . . .	8W-41-2	Low Note Horn . . . . .	8W-41-2
G200 . . . . .	8W-41-2	Right Horn Switch . . . . .	8W-41-2
High Note Horn . . . . .	8W-41-2		



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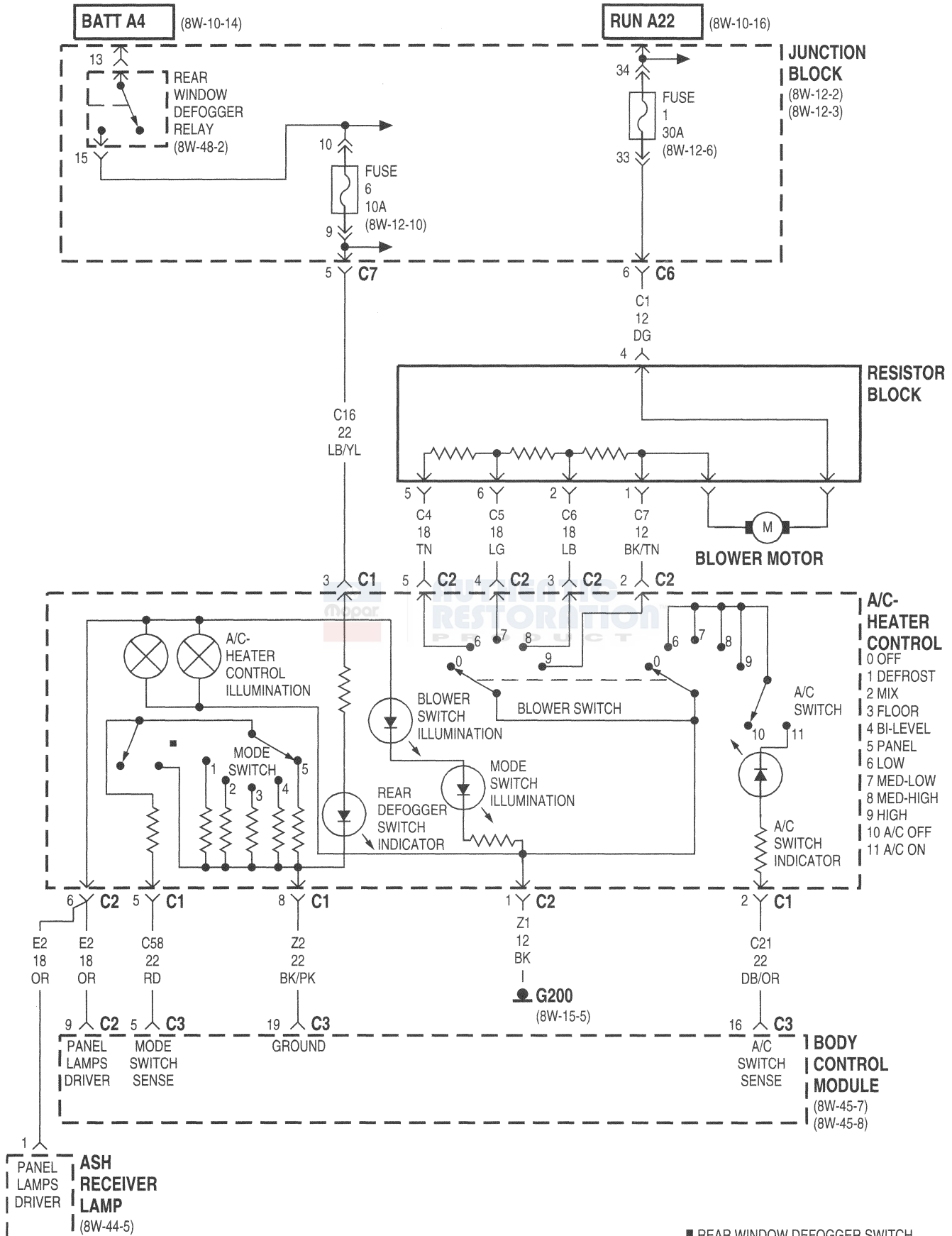
**8W-42 AIR CONDITIONING-HEATER**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
A/C Compressor Clutch .....	8W-42-3	G102 .....	8W-42-4
A/C Compressor Clutch Relay .....	8W-42-3	G200 .....	8W-42-2
A/C Evaporator Temperature Sensor .....	8W-42-3	High Speed Radiator Fan Relay .....	8W-42-4
A/C Pressure Transducer .....	8W-42-3	Junction Block .....	8W-42-2
A/C- Heater Control .....	8W-42-2	Low Speed Radiator Fan Relay .....	8W-42-4
Ash Receiver Lamp .....	8W-42-2	Mode Door Actuator .....	8W-42-3
Blower Motor .....	8W-42-2	Power Distribution Center .....	8W-42-3, 4
Body Control Module .....	8W-42-2, 3	Powertrain Control Module .....	8W-42-3, 4
Fuse 1 (JB) .....	8W-42-2	Radiator Fan Motor Assembly .....	8W-42-4
Fuse 6 (JB) .....	8W-42-2	Rear Window Defogger Relay .....	8W-42-2
Fuse 9 (PDC) .....	8W-42-3, 4	Resistor Block .....	8W-42-2
Fuse 19 (PDC) .....	8W-42-3, 4		

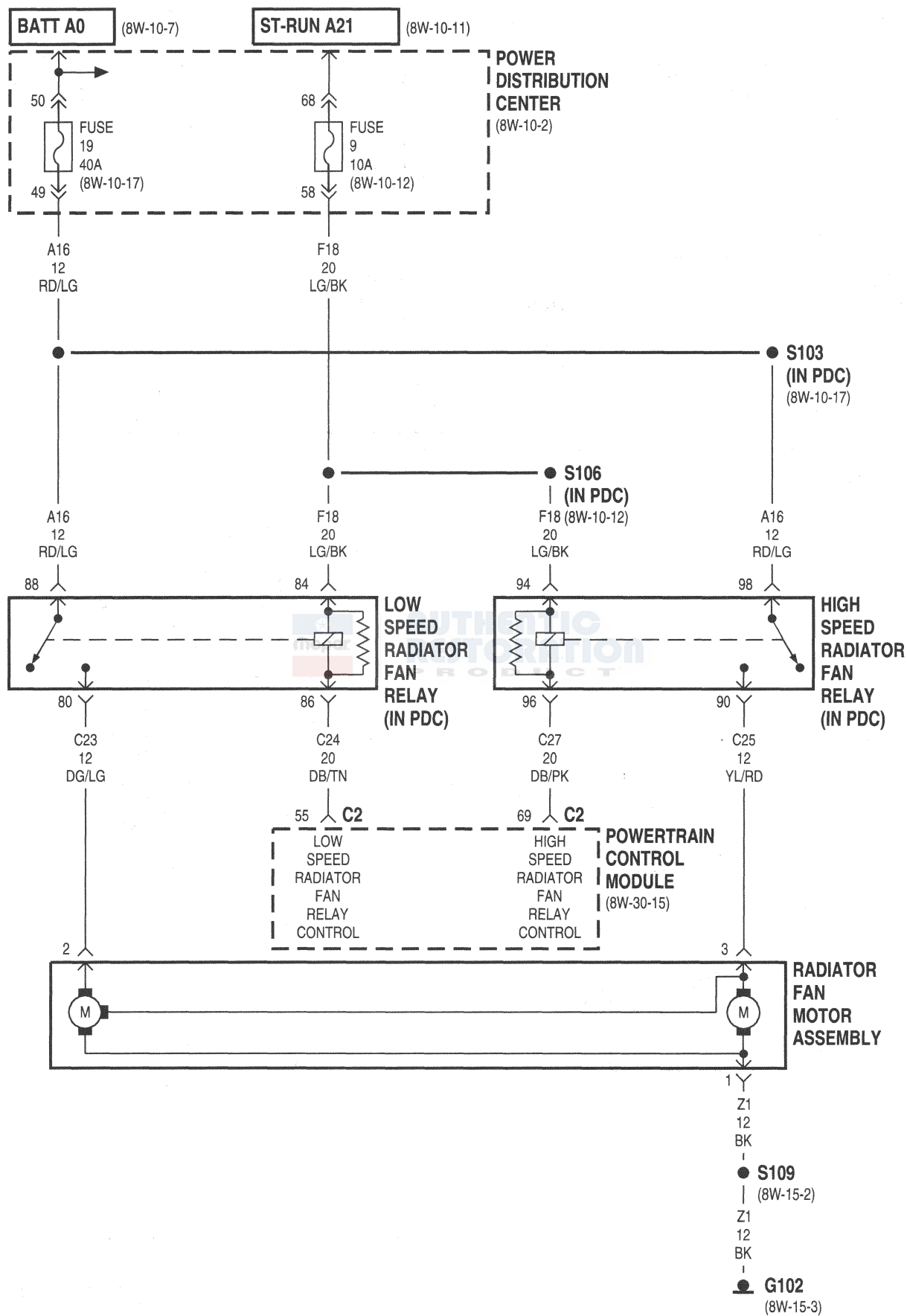


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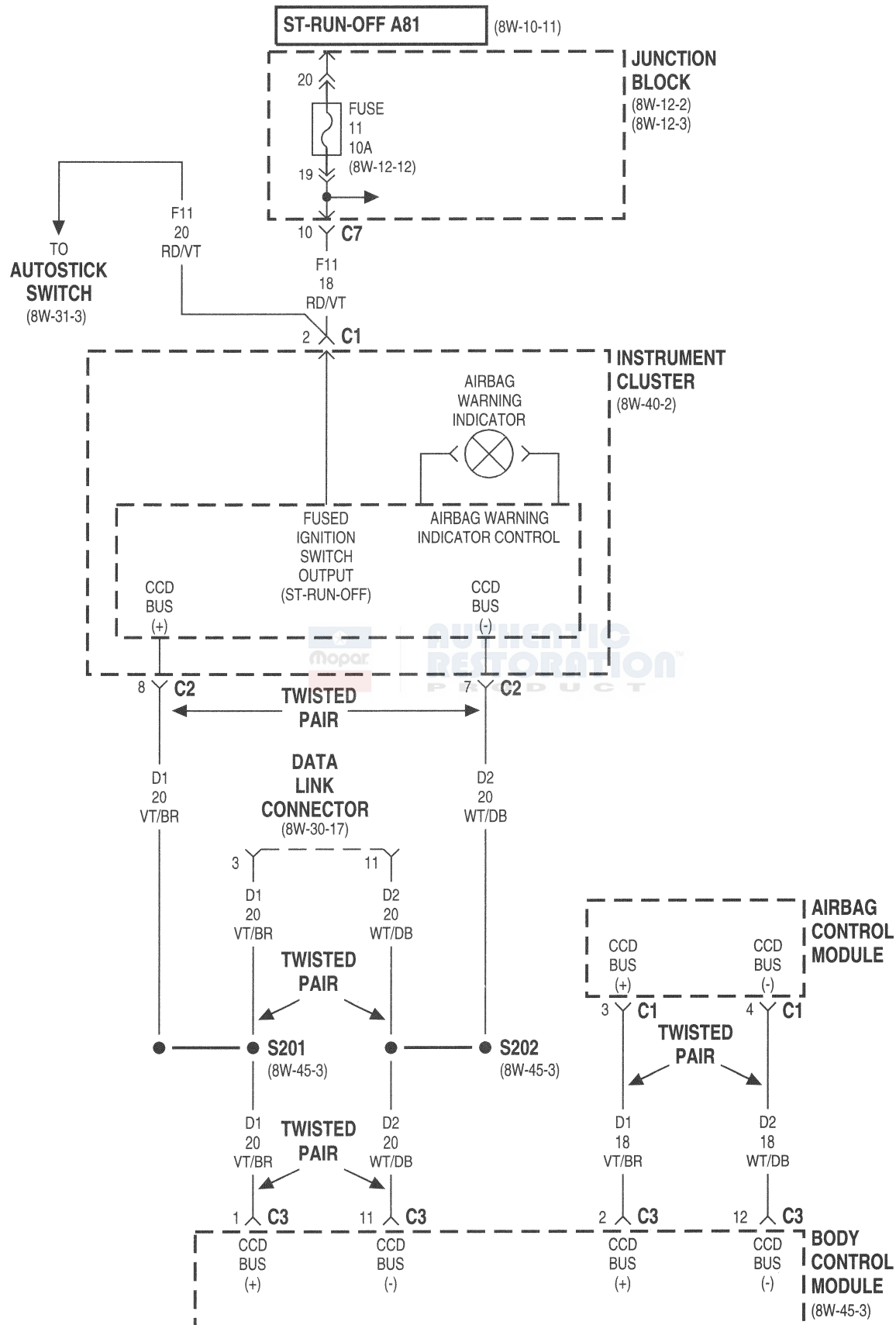
## 8W-43 AIRBAG SYSTEM

Component	Page	Component	Page
Airbag Control Module . . . . .	8W-43-2, 3	Fuse 11 (JB) . . . . .	8W-43-3
Airbag Warning Indicator . . . . .	8W-43-3	Fuse 16 (JB) . . . . .	8W-43-2
Autostick Switch . . . . .	8W-43-3	Fuse 17 (JB) . . . . .	8W-43-2
Body Control Module . . . . .	8W-43-3	G201 . . . . .	8W-43-2
Clockspring No. 2 . . . . .	8W-43-2	Instrument Cluster . . . . .	8W-43-3
Data Link Connector . . . . .	8W-43-3	Junction Block . . . . .	8W-43-2, 3
Driver Side Airbag . . . . .	8W-43-2	Passenger Side Airbag . . . . .	8W-43-2



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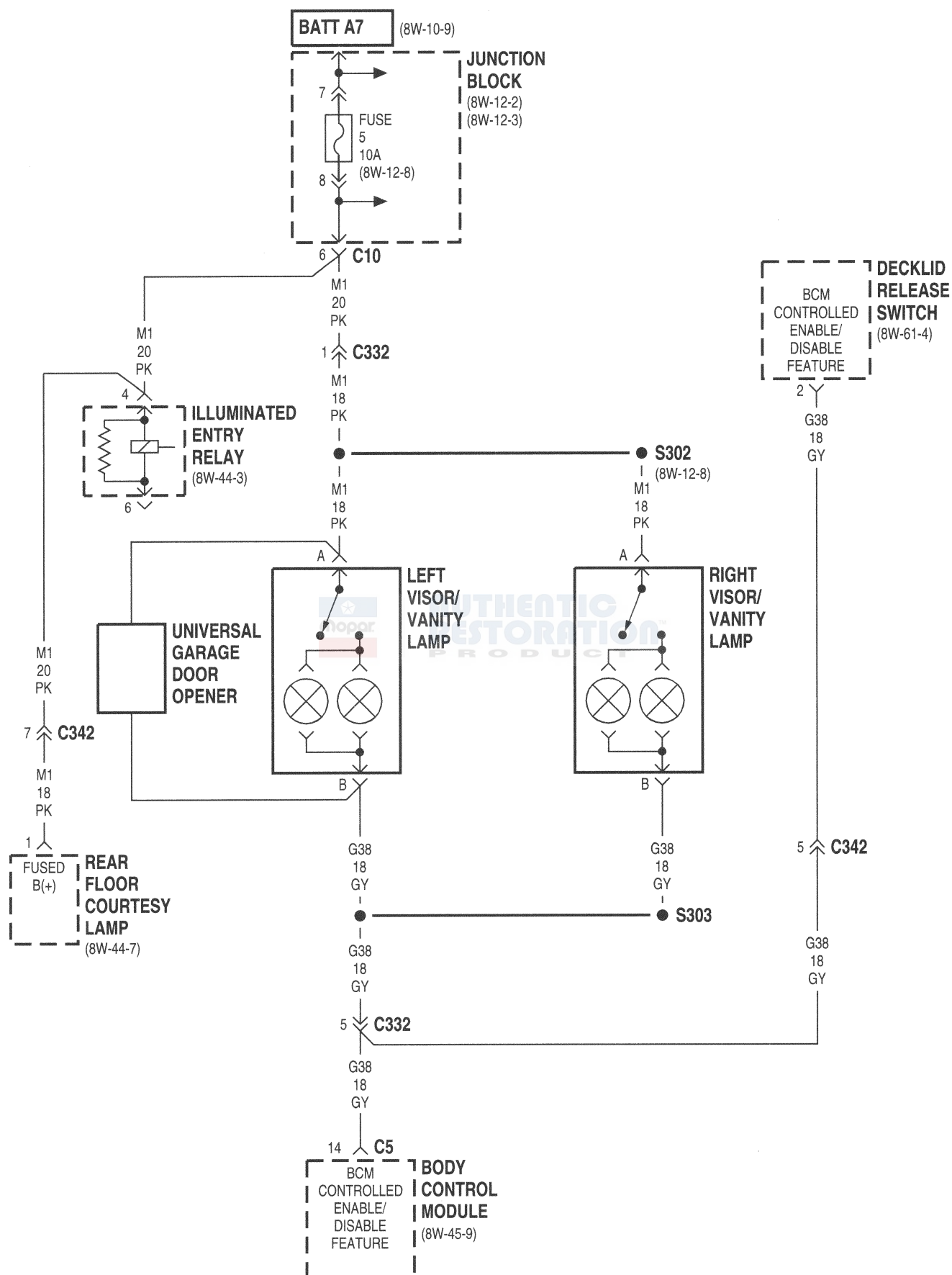


## **8W-44 INTERIOR LIGHTING**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
A/C- Heater Control .....	8W-44-5	Left Back-Up Lamp .....	8W-44-6
Ash Receiver Lamp .....	8W-44-5	Left Door Courtesy Lamp .....	8W-44-7
Automatic Day/Night Mirror .....	8W-44-6	Left Visor/Vanity Lamp .....	8W-44-2
Body Control Module .....	8W-44-2, 3, 4, 5, 7	Overhead Map Lamp .....	8W-44-3, 6, 7
Cluster Illumination Lamps .....	8W-44-4	Panel Lamps Dimmer Switch .....	8W-44-4
Decklid Release Switch .....	8W-44-2	Power Top Switch .....	8W-44-5
Fuse 4 (JB) .....	8W-44-6	PRNDL Illumination LED .....	8W-44-5
Fuse 5 (JB) .....	8W-44-2, 3, 6, 7	Radio .....	8W-44-7
Fuse 7 (JB) .....	8W-44-4	Rear Floor Courtesy Lamp .....	8W-44-2, 3, 6, 7
G200 .....	8W-44-3, 5	Right Back-Up Lamp .....	8W-44-6
G301 .....	8W-44-3, 4, 5, 6	Right Door Courtesy Lamp .....	8W-44-7
G306 .....	8W-44-5	Right Visor/Vanity Lamp .....	8W-44-2
Glove Box Lamp .....	8W-44-3	Traction Control Switch .....	8W-44-4, 5
Headlamp Switch .....	8W-44-4, 5	Transmission Range Sensor .....	8W-44-6
Illuminated Entry Relay .....	8W-44-2, 3, 6, 7	Trunk Ajar Switch .....	8W-44-3
Instrument Cluster .....	8W-44-4	Trunk Lamp .....	8W-44-3
Junction Block .....	8W-44-2, 3, 4, 5, 6, 7	Universal Garage Door Opener .....	8W-44-2

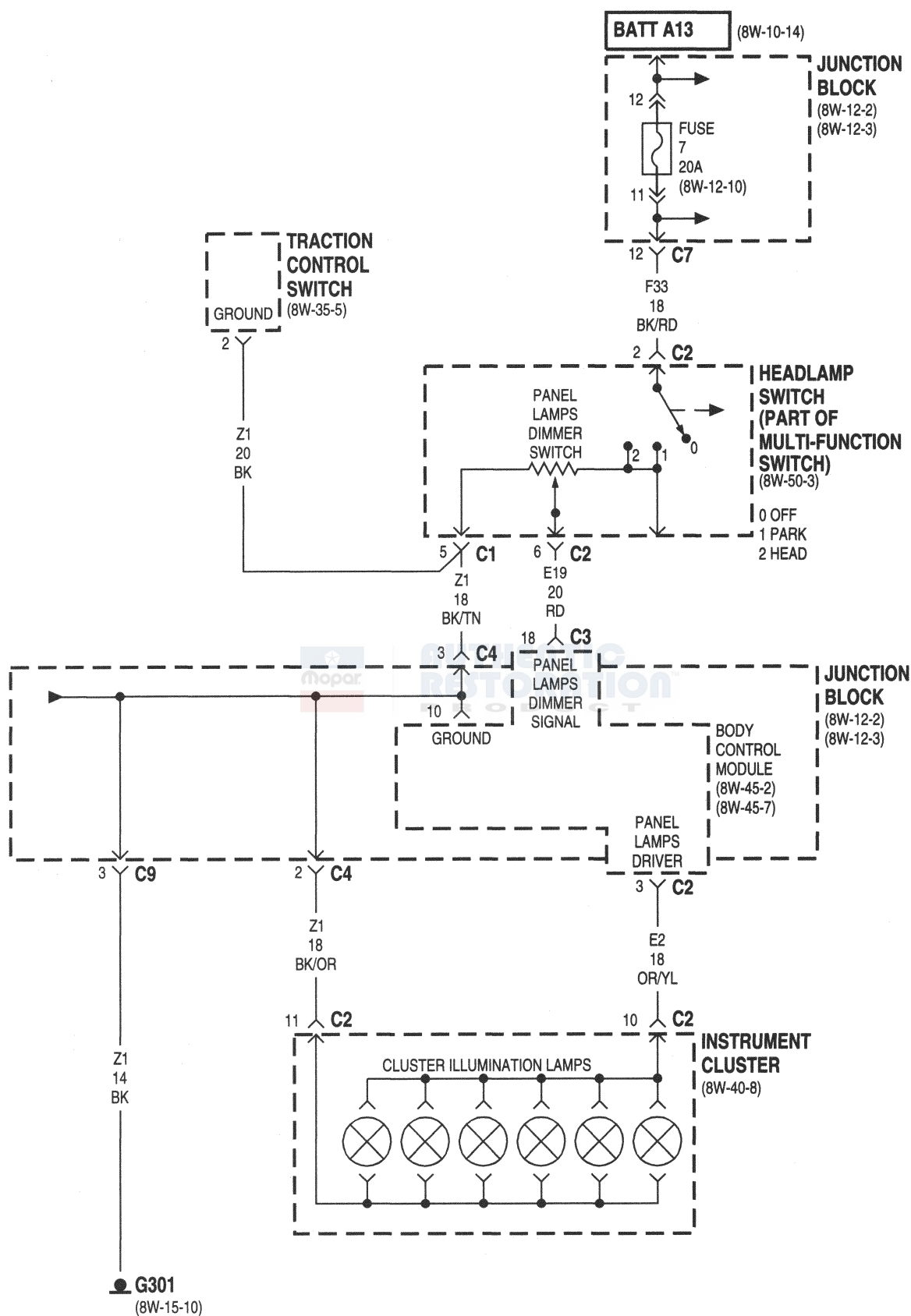


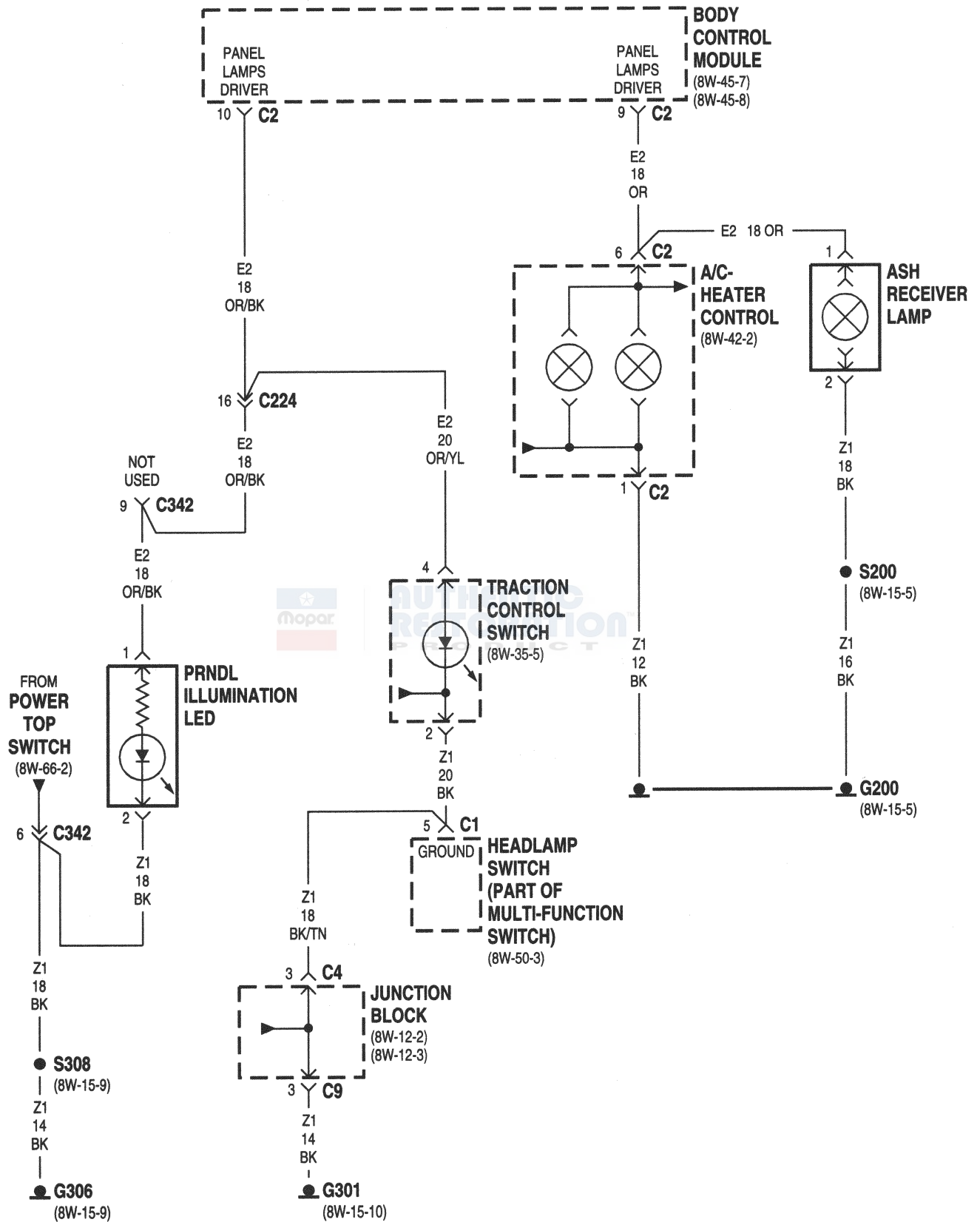
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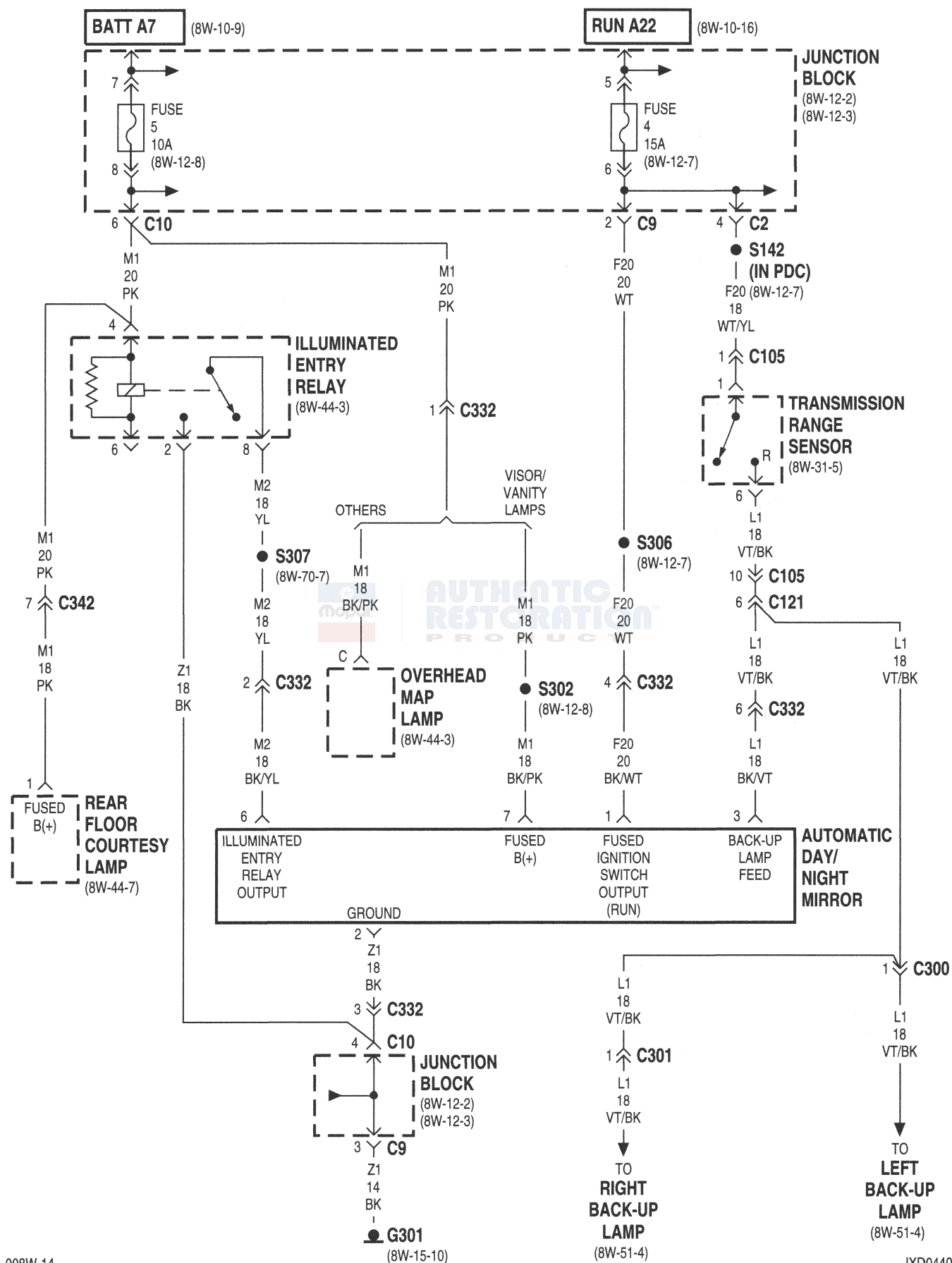




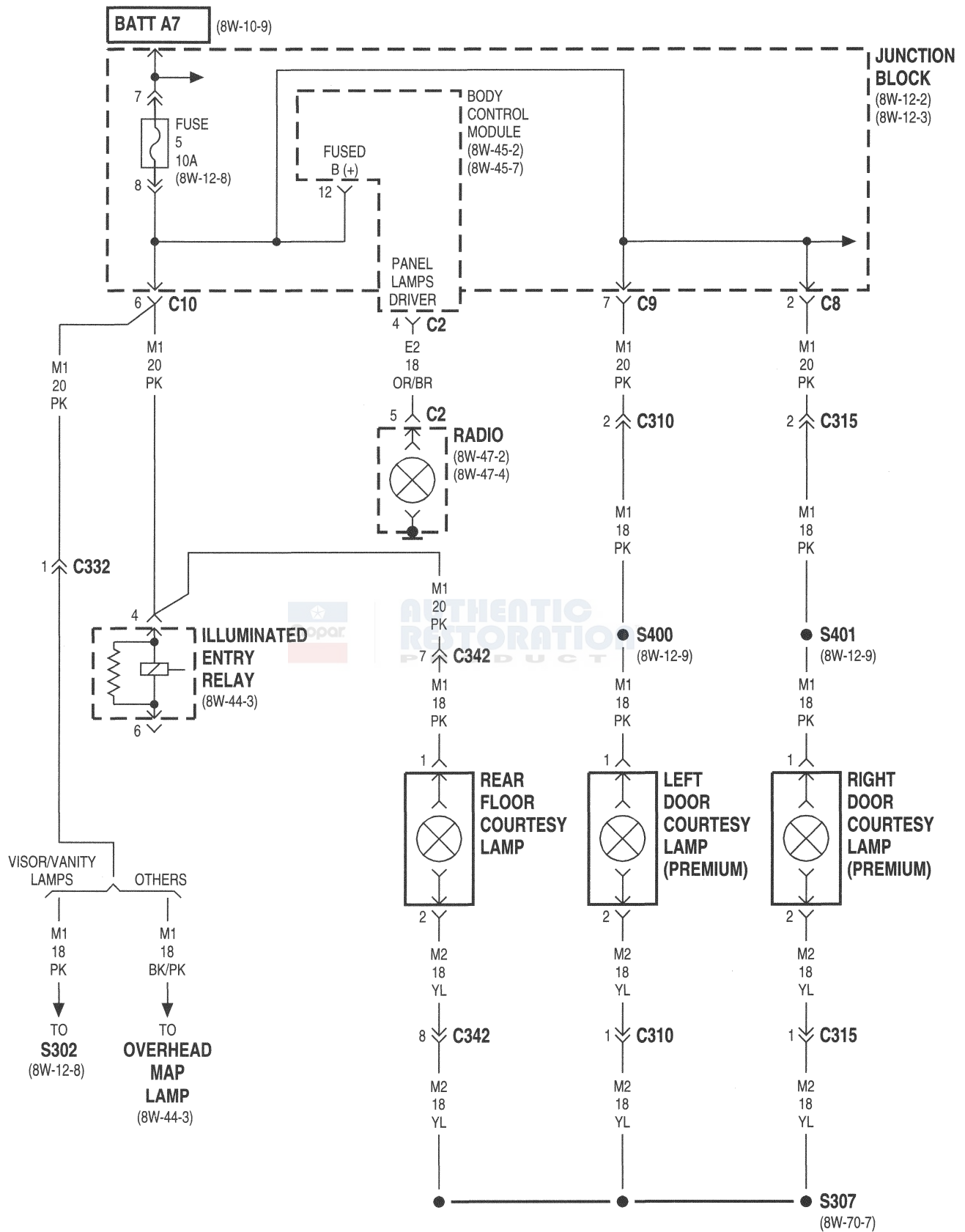






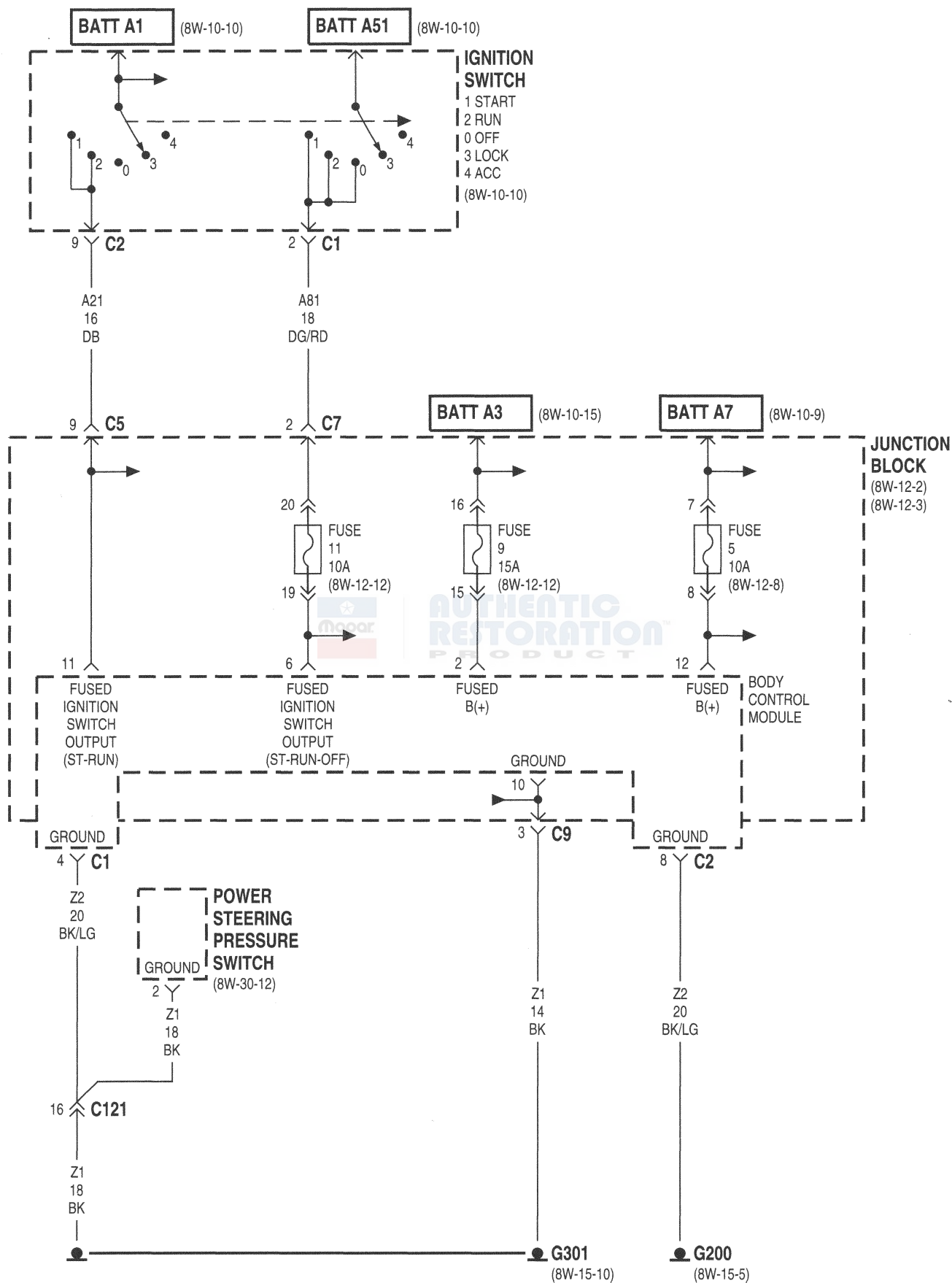




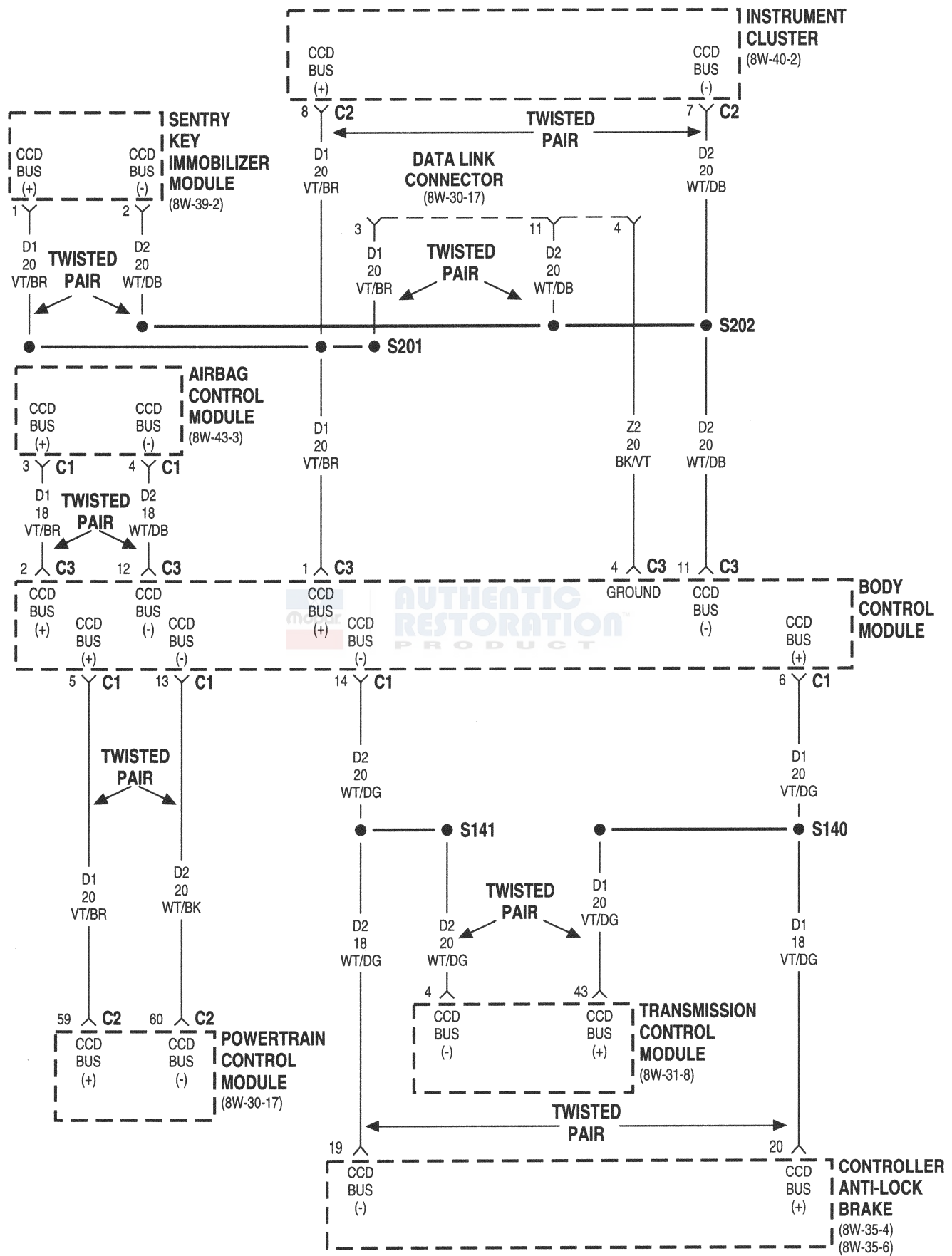


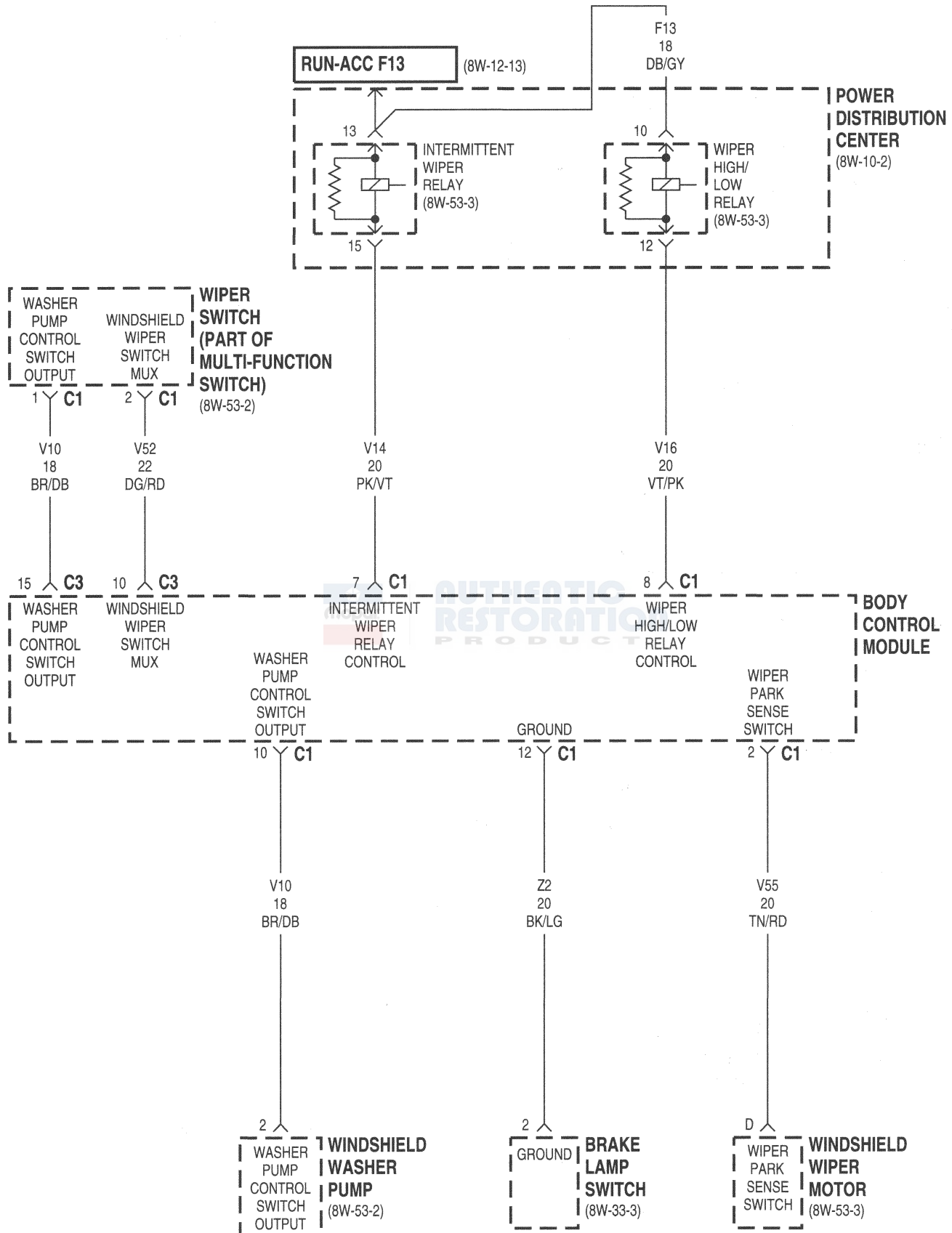
## **8W-45 BODY CONTROL MODULE**

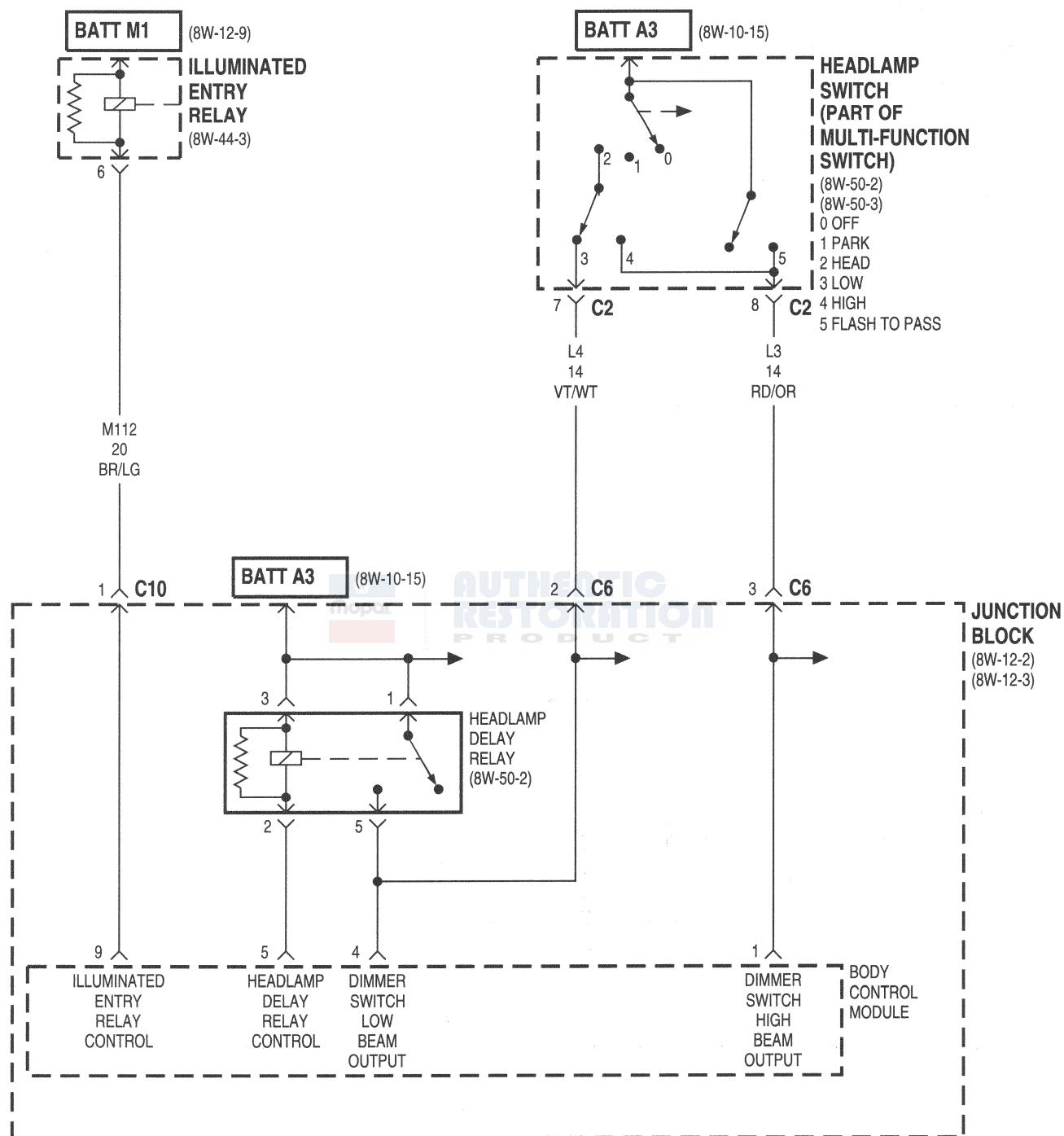
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
A/C Evaporator Temperature Sensor . . . . .	8W-45-8	Left Remote Keyless Entry Antenna . . . . .	8W-45-10
A/C- Heater Control . . . . .	8W-45-7, 8	Left Side Marker Lamp . . . . .	8W-45-6
Airbag Control Module . . . . .	8W-45-3	Left Tail/Stop Lamp . . . . .	8W-45-6
Ash Receiver Lamp . . . . .	8W-45-7	Left Visor/Vanity Lamp . . . . .	8W-45-9
Body Control Module . . . . .	8W-45-2, 3, 4, 5, 6, 7, 8, 9, 10, 11,	License Lamp . . . . .	8W-45-6
Brake Lamp Switch . . . . .	8W-45-4	Mode Door Actuator . . . . .	8W-45-8
Clockspring No. 1 . . . . .	8W-45-12	Power Distribution Center . . . . .	8W-45-4
Controller Anti-Lock Brake . . . . .	8W-45-3	Power Steering Pressure Switch . . . . .	8W-45-2
Data Link Connector . . . . .	8W-45-3	Power Top Relay . . . . .	8W-45-9
Decklid Release Relay . . . . .	8W-45-9	Powertrain Control Module . . . . .	8W-45-3
Decklid Release Switch . . . . .	8W-45-9	PRNDL Illumination LED . . . . .	8W-45-7
Fuel Pump Module . . . . .	8W-45-9	Radio . . . . .	8W-45-6, 7
Fuse 5 (JB) . . . . .	8W-45-2	Rear Window Defogger Relay . . . . .	8W-45-12
Fuse 8 (JB) . . . . .	8W-45-12	Right Door Ajar Switch . . . . .	8W-45-11
Fuse 9 (JB) . . . . .	8W-45-2	Right Door Arm/Disarm Switch . . . . .	8W-45-11
Fuse 11 (JB) . . . . .	8W-45-2	Right Horn Switch . . . . .	8W-45-12
Fuse 15 (JB) . . . . .	8W-45-12	Right Park/Turn Signal Lamp . . . . .	8W-45-6
G200 . . . . .	8W-45-2	Right Power Door Lock Motor . . . . .	8W-45-10
G301 . . . . .	8W-45-2, 9	Right Power Door Lock Switch . . . . .	8W-45-10
G306 . . . . .	8W-45-9	Right Rear Park/Turn Signal Lamp . . . . .	8W-45-6
Headlamp Delay Relay . . . . .	8W-45-5	Right Remote Keyless Entry Antenna . . . . .	8W-45-10
Headlamp Switch . . . . .	8W-45-5, 6, 7	Right Side Marker Lamp . . . . .	8W-45-6
Horn Relay . . . . .	8W-45-12	Right Tail/Stop Lamp . . . . .	8W-45-6
Horn Switches . . . . .	8W-45-12	Right Visor/Vanity Lamp . . . . .	8W-45-9
Ignition Switch . . . . .	8W-45-2	Seat Belt Control Module . . . . .	8W-45-11
Illuminated Entry Relay . . . . .	8W-45-5	Seat Belt Switch . . . . .	8W-45-9
Instrument Cluster . . . . .	8W-45-3, 7, 11	Sentry Key Immobilizer Module . . . . .	8W-45-3
Intermittent Wiper Relay . . . . .	8W-45-4	Traction Control Switch . . . . .	8W-45-7
Junction Block . . . . .	8W-45-2, 5, 6, 9, 12	Transmission Control Module . . . . .	8W-45-3
Key-In Switch . . . . .	8W-45-9	Trunk Ajar Switch . . . . .	8W-45-11
Left Door Ajar Switch . . . . .	8W-45-11	Trunk Key Cylinder Switch . . . . .	8W-45-11
Left Door Arm/Disarm Switch . . . . .	8W-45-11	Trunk Lamp . . . . .	8W-45-11
Left Horn Switch . . . . .	8W-45-12	Universal Garage Door Opener . . . . .	8W-45-9
Left Park/Turn Signal Lamp . . . . .	8W-45-6	Windshield Washer Pump . . . . .	8W-45-4
Left Power Door Lock Motor . . . . .	8W-45-10	Windshield Wiper Motor . . . . .	8W-45-4
Left Power Door Lock Switch . . . . .	8W-45-10	Wiper High/Low Relay . . . . .	8W-45-4
Left Rear Park/Turn Signal Lamp . . . . .	8W-45-6	Wiper Switch . . . . .	8W-45-4



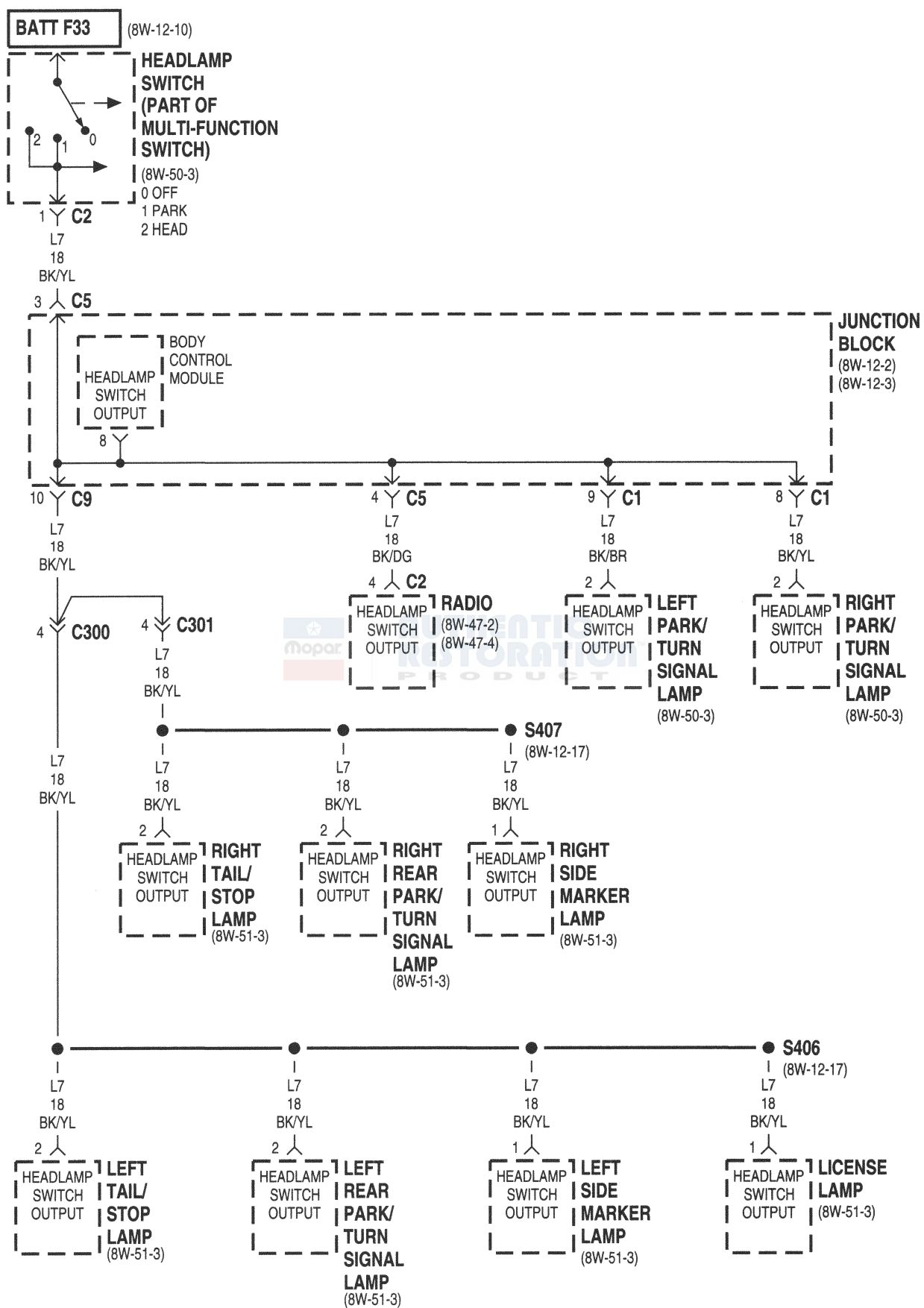


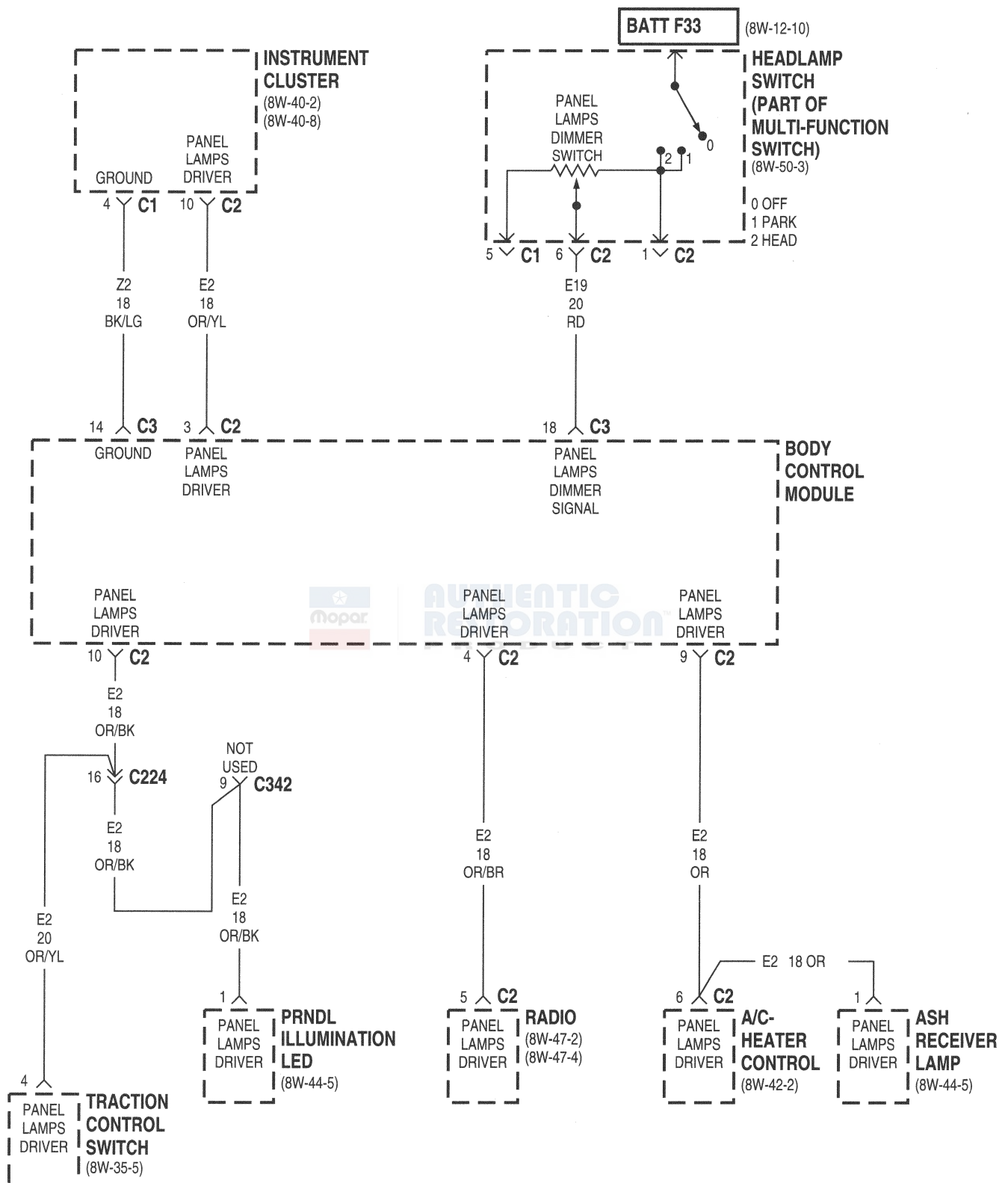


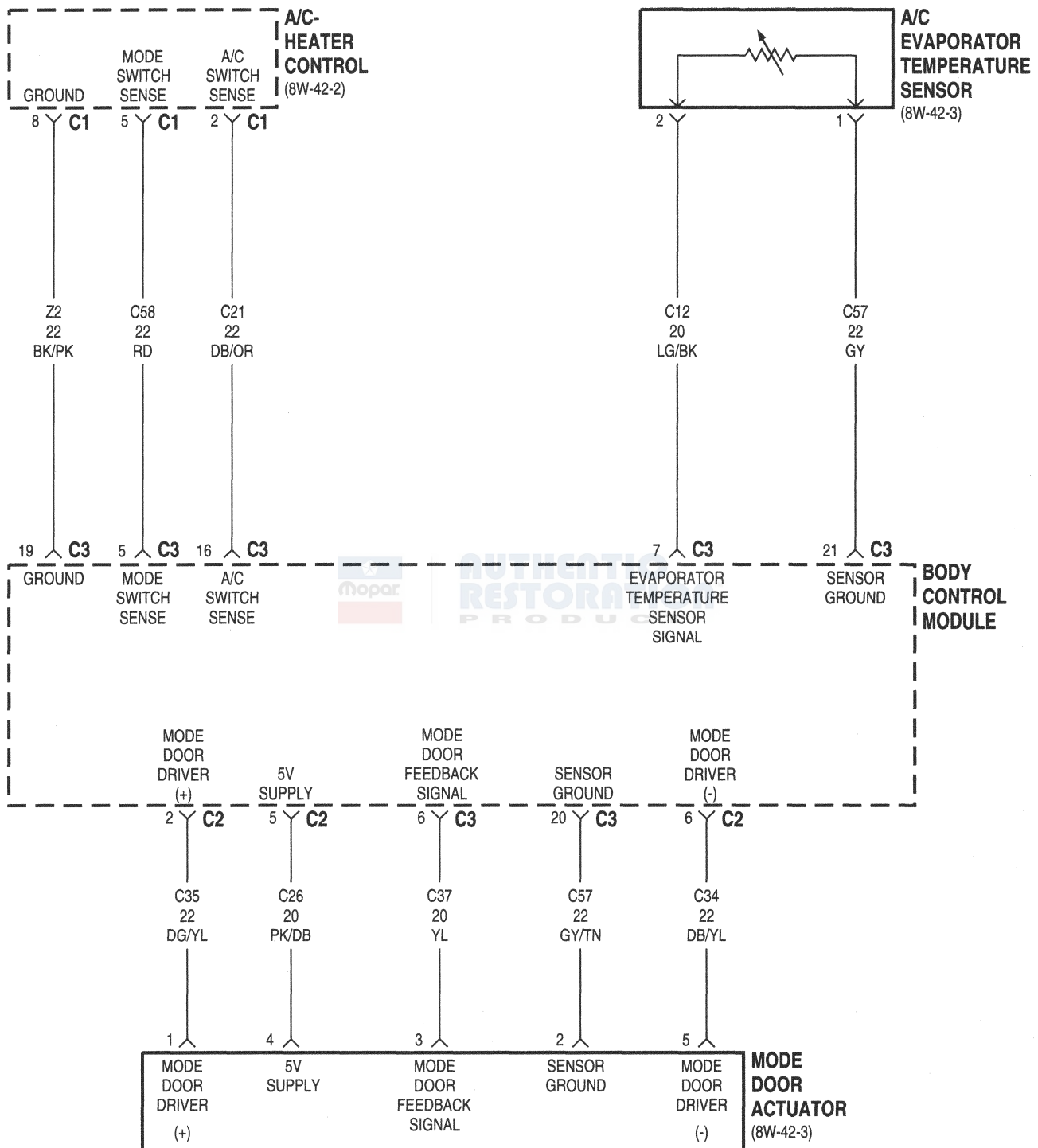






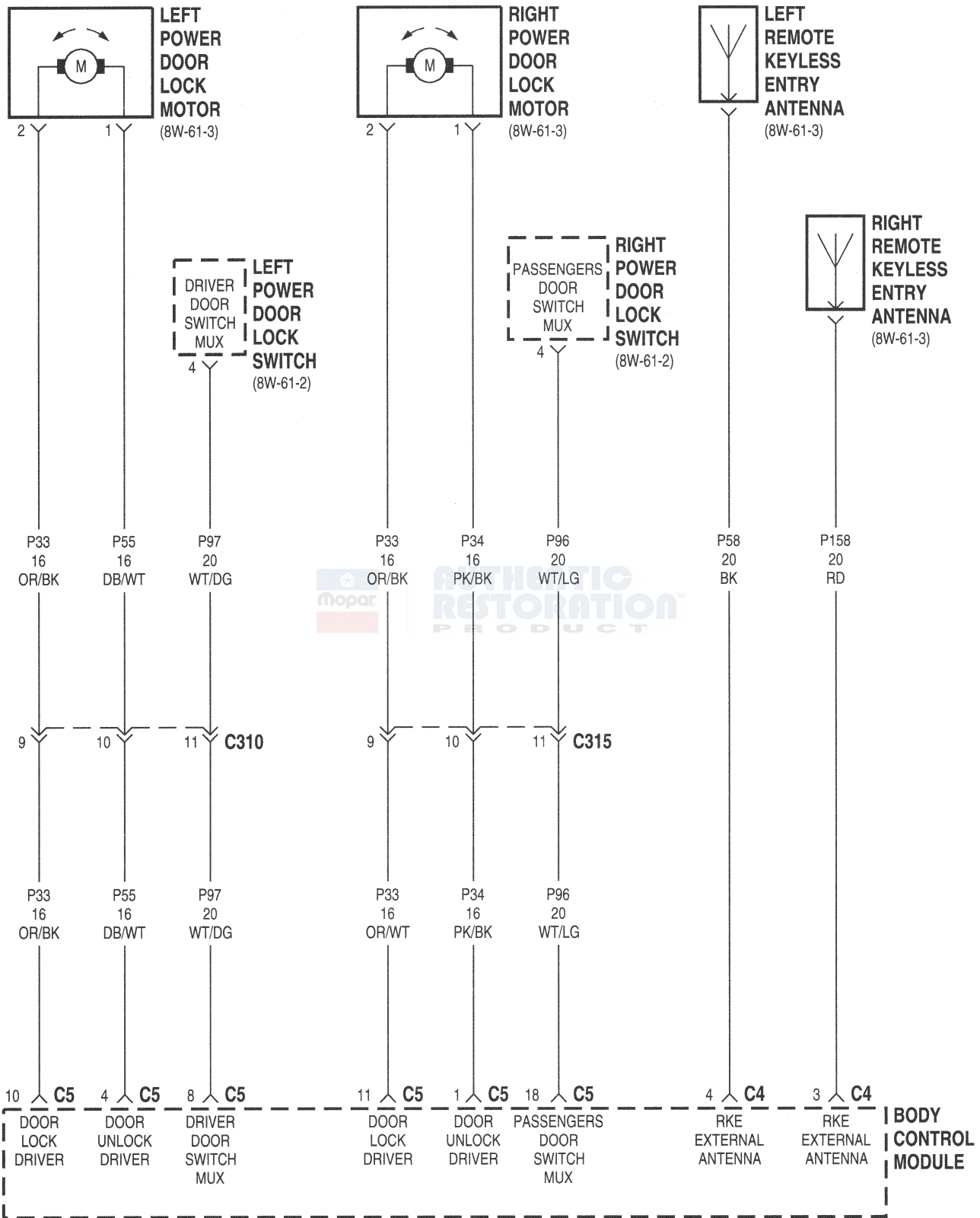


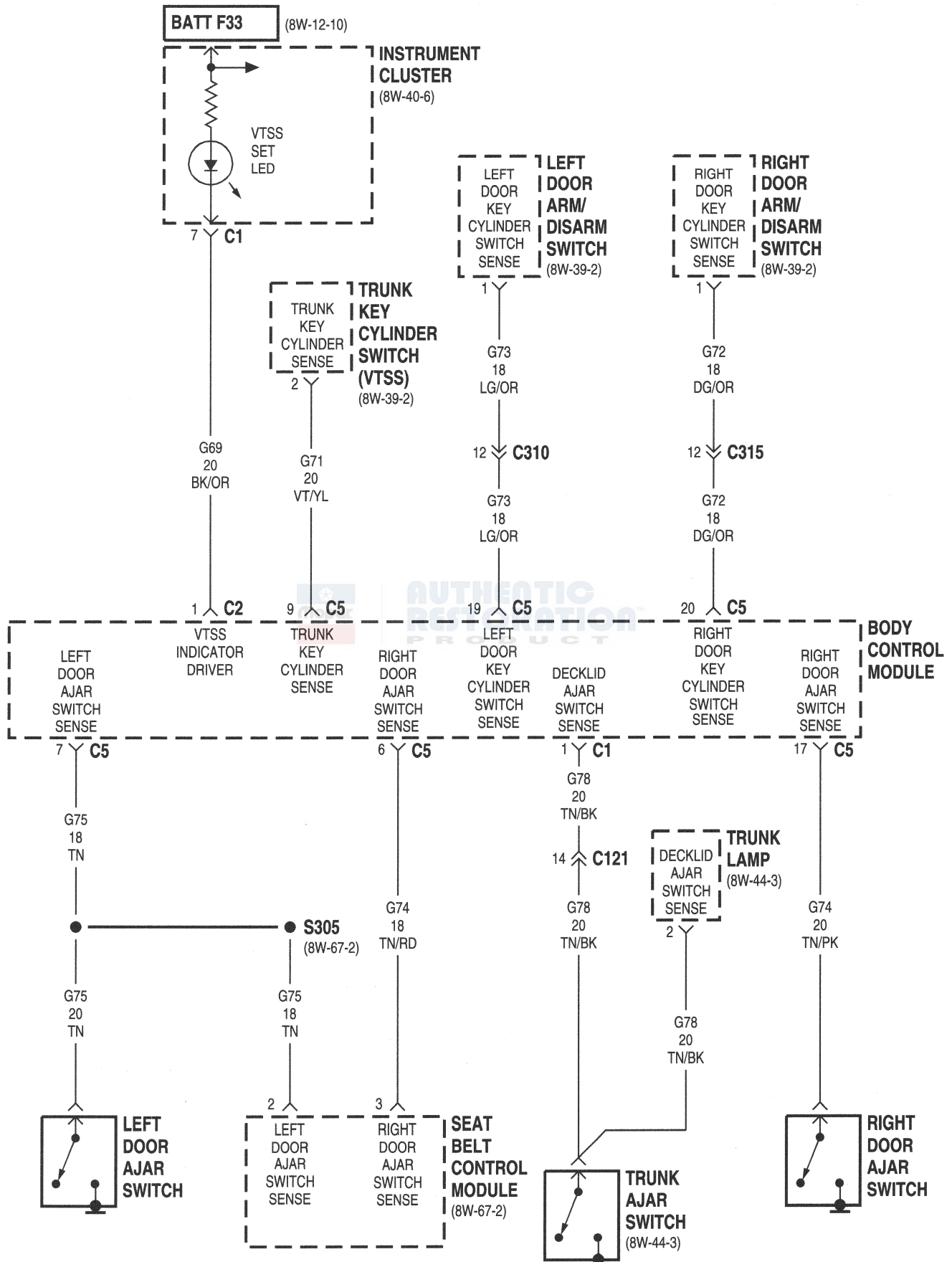




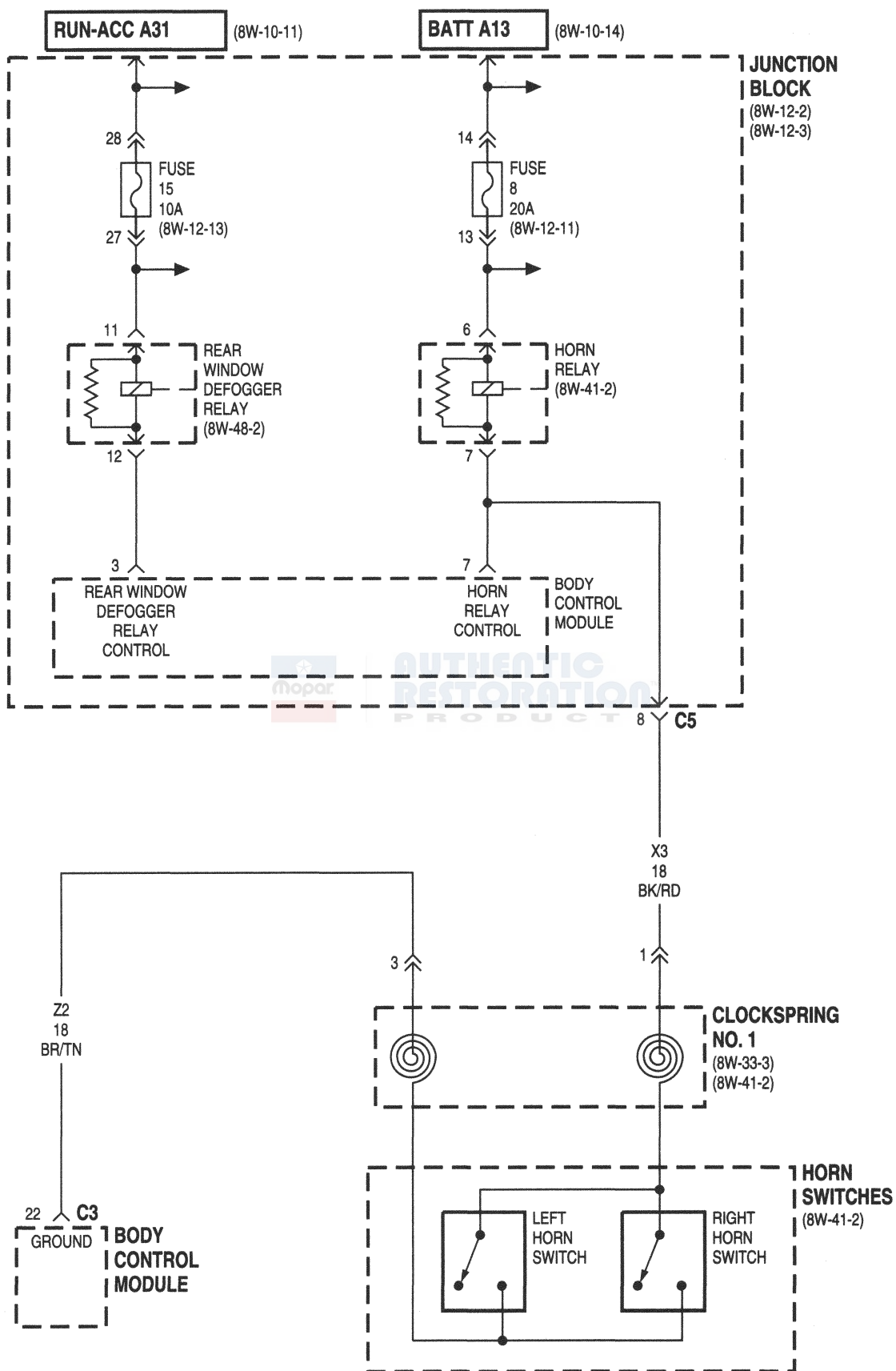












## 8W-46 TRAVELER

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Body Control Module .....	8W-46-2	Instrument Cluster .....	8W-46-2
Data Link Connector .....	8W-46-2	Junction Block .....	8W-46-2
Fuse 5 (JB) .....	8W-46-2	Traveler .....	8W-46-2
G200 .....	8W-46-2		



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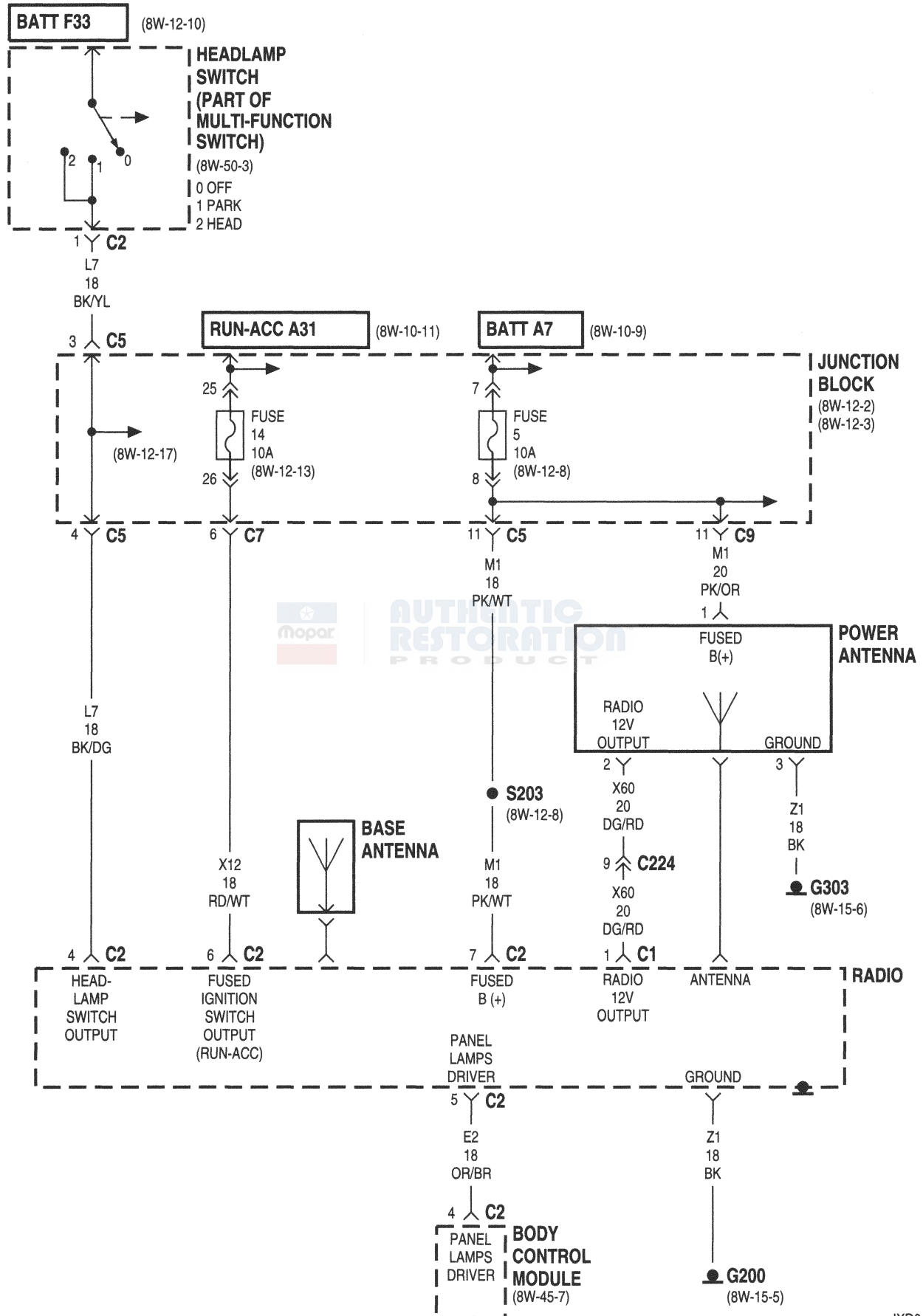


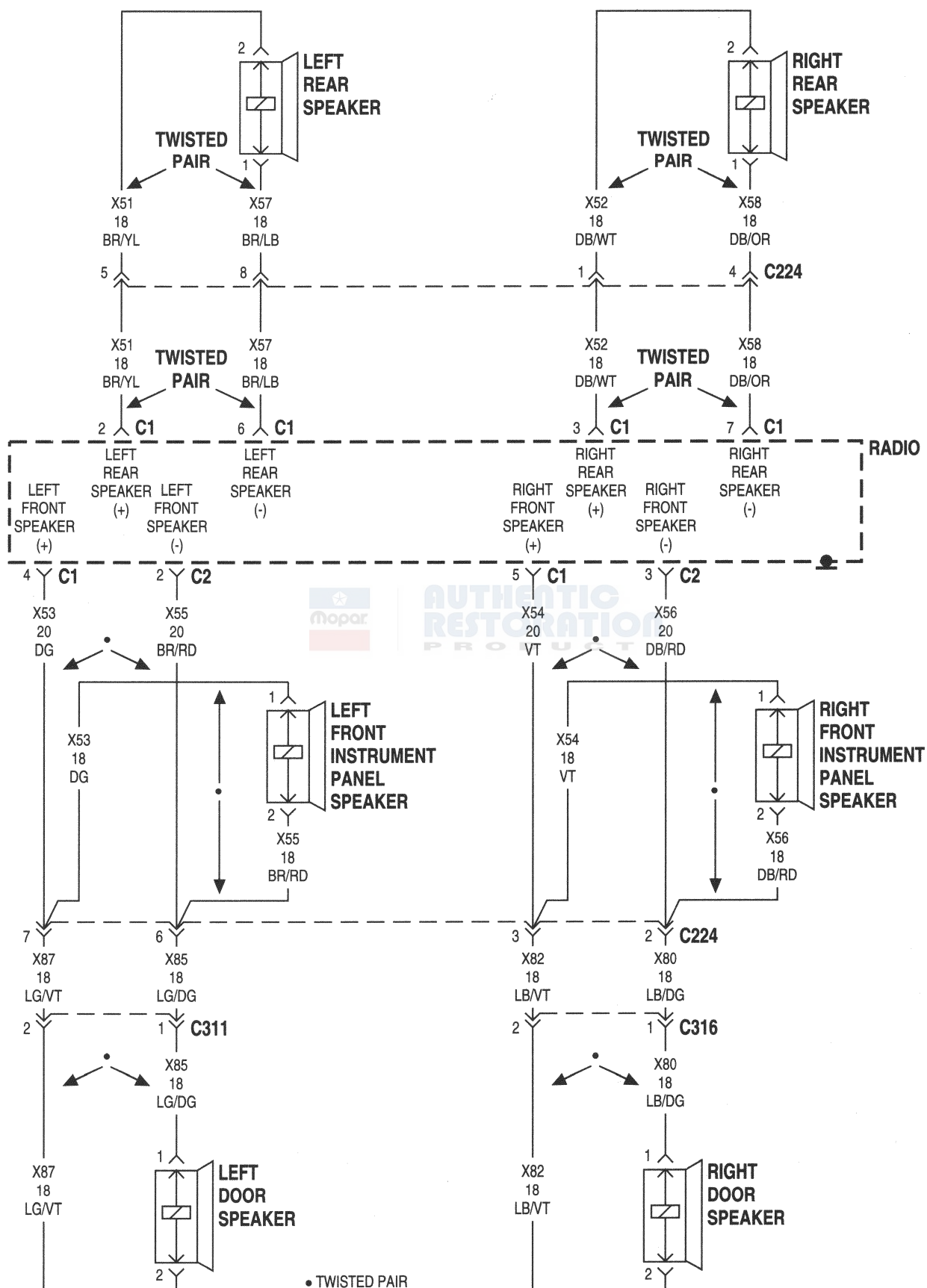
## **8W-47 AUDIO SYSTEM**

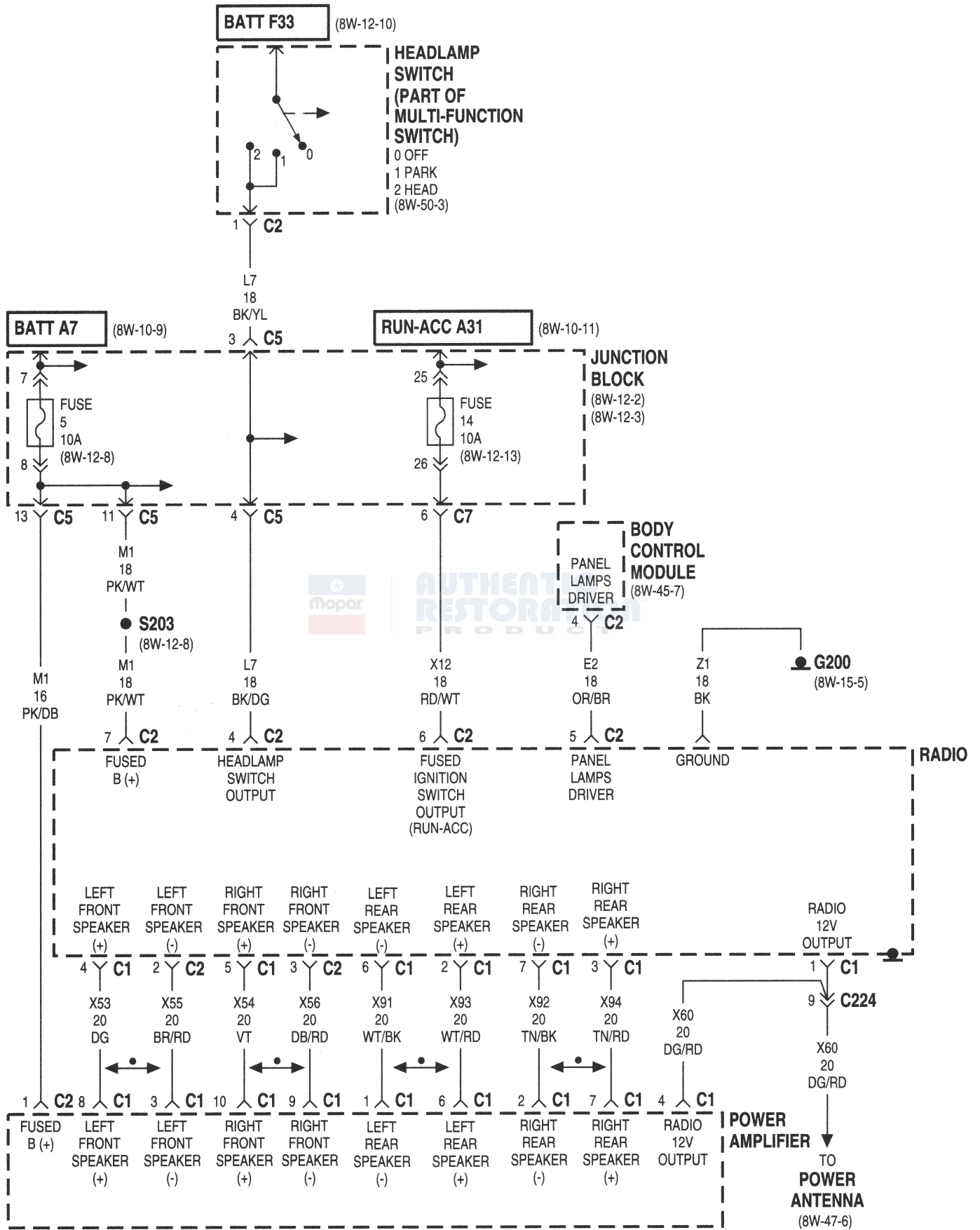
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Base Antenna .....	8W-47-2	Left Front Instrument Panel Speaker . . .	8W-47-3, 5
Body Control Module .....	8W-47-2, 4	Left Rear Speaker .....	8W-47-3, 5
Fuse 5 (JB) .....	8W-47-2, 4, 6	Power Amplifier .....	8W-47-4, 5, 6
Fuse 14 (JB) .....	8W-47-2, 4	Power Antenna .....	8W-47-2, 4, 6
G200 .....	8W-47-2, 4	Power Top Switch .....	8W-47-6
G301 .....	8W-47-6	Radio .....	8W-47-2, 3, 4, 6
G303 .....	8W-47-2, 6	Right Door Speaker .....	8W-47-3, 5
Headlamp Switch .....	8W-47-2, 4	Right Front Instrument Panel Speaker . .	8W-47-3, 5
Junction Block .....	8W-47-2, 4, 6	Right Rear Speaker .....	8W-47-3, 5
Left Door Speaker .....	8W-47-3, 5		



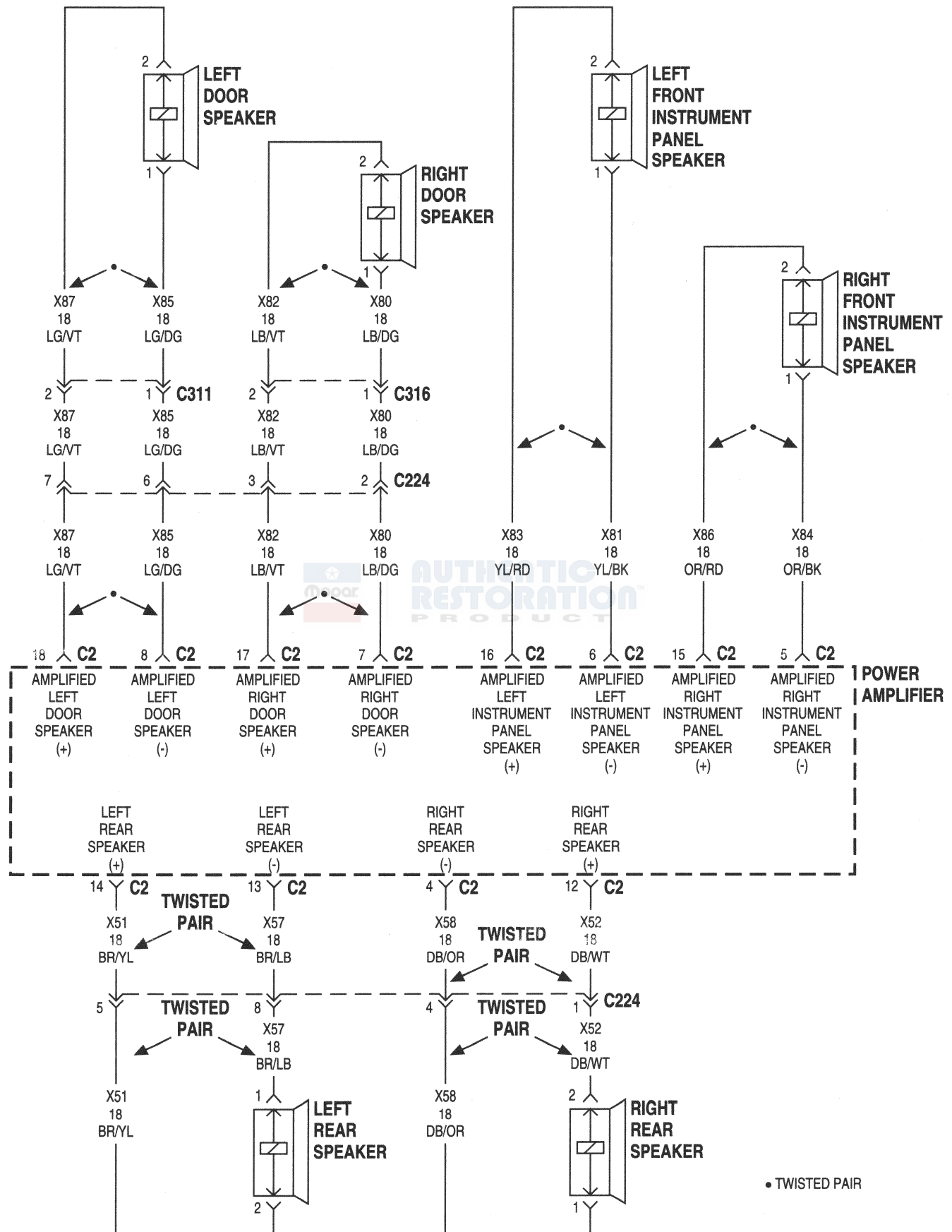
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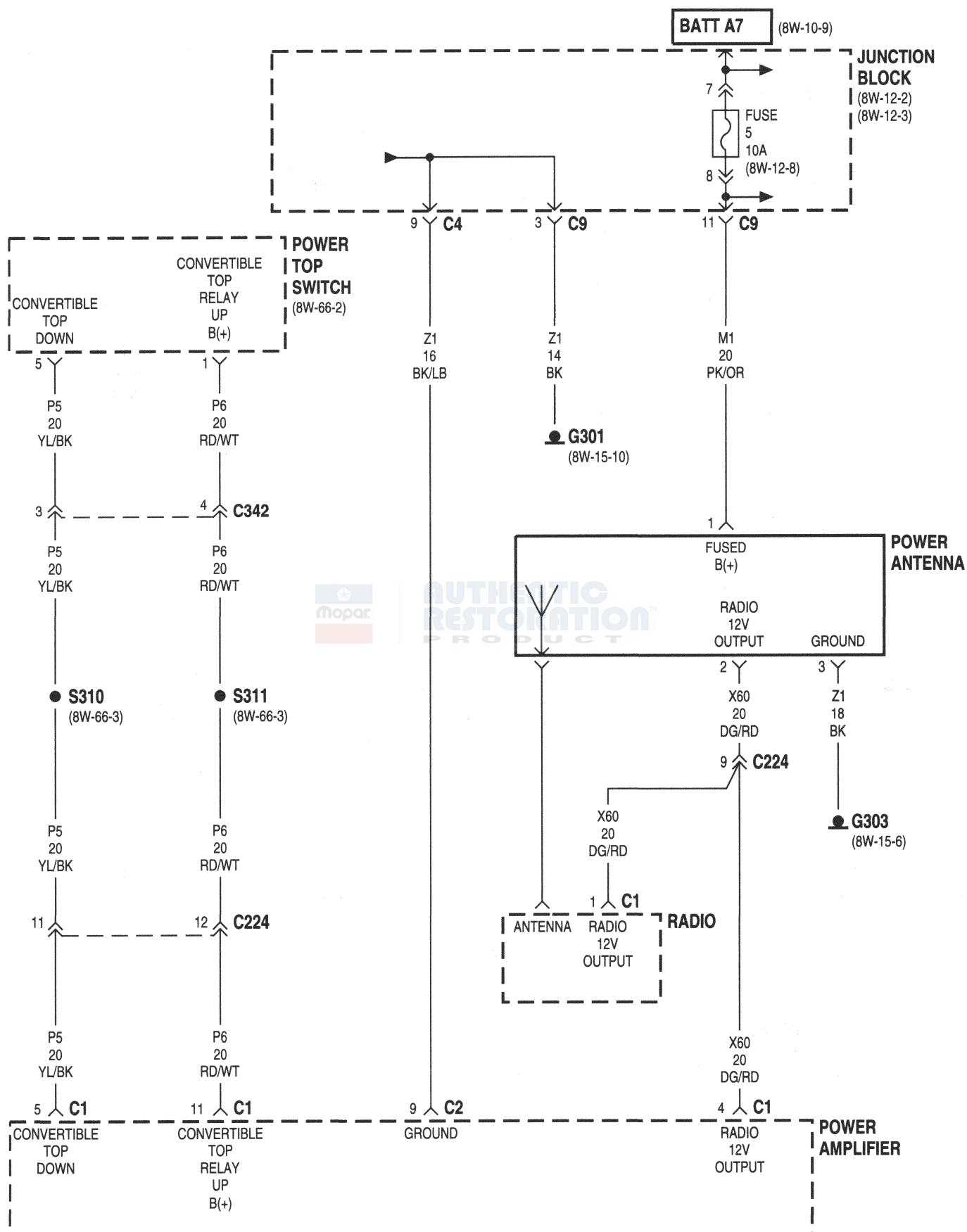










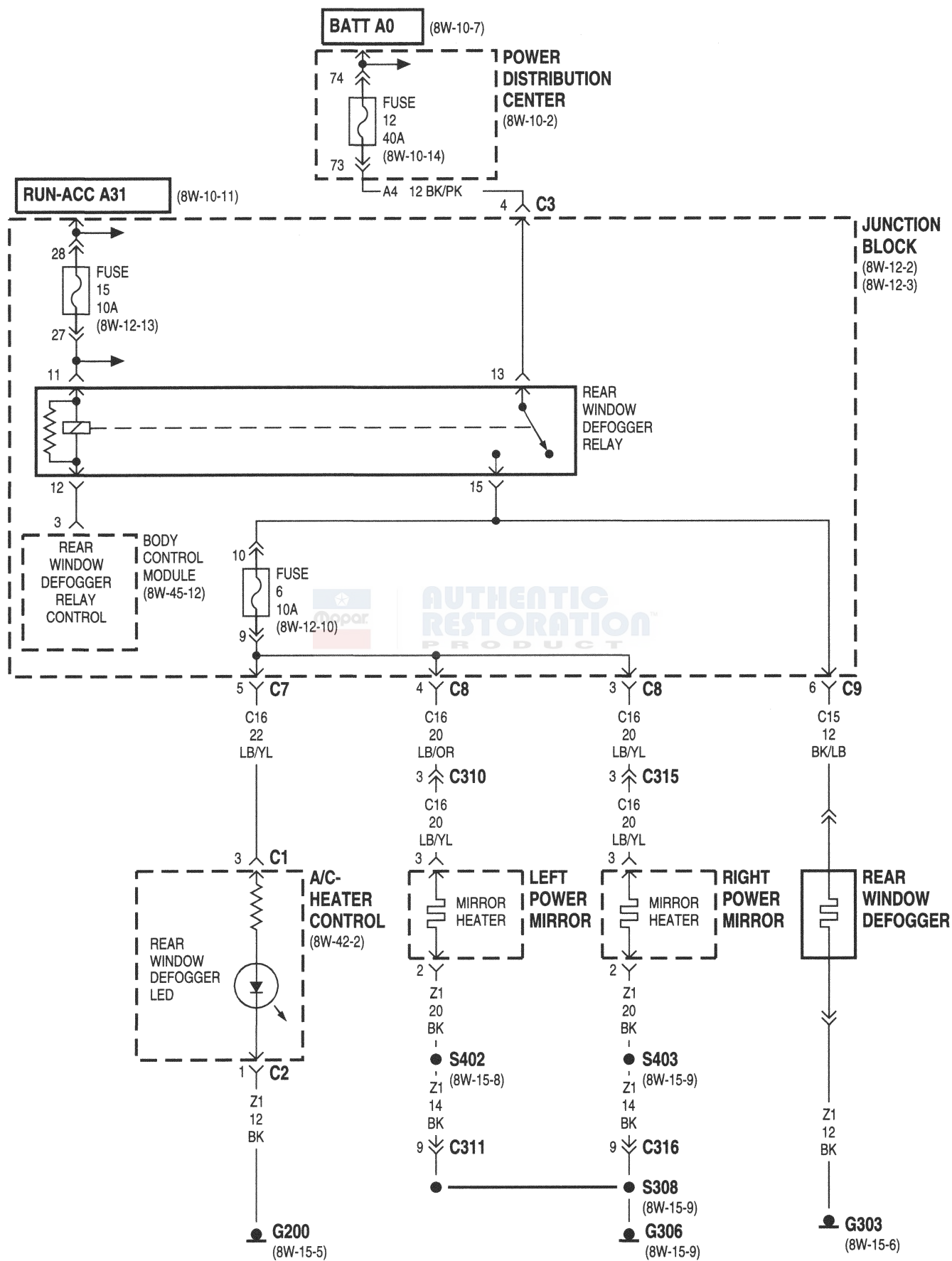


## **8W-48 REAR WINDOW DEFOGGER**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
A/C- Heater Control .....	8W-48-2	G306 .....	8W-48-2
Body Control Module .....	8W-48-2	Junction Block .....	8W-48-2
Fuse 6 (JB) .....	8W-48-2	Left Power Mirror .....	8W-48-2
Fuse 12 (PDC) .....	8W-48-2	Power Distribution Center .....	8W-48-2
Fuse 15 (JB) .....	8W-48-2	Rear Window Defogger .....	8W-48-2
G200 .....	8W-48-2	Rear Window Defogger Relay .....	8W-48-2
G303 .....	8W-48-2	Right Power Mirror .....	8W-48-2



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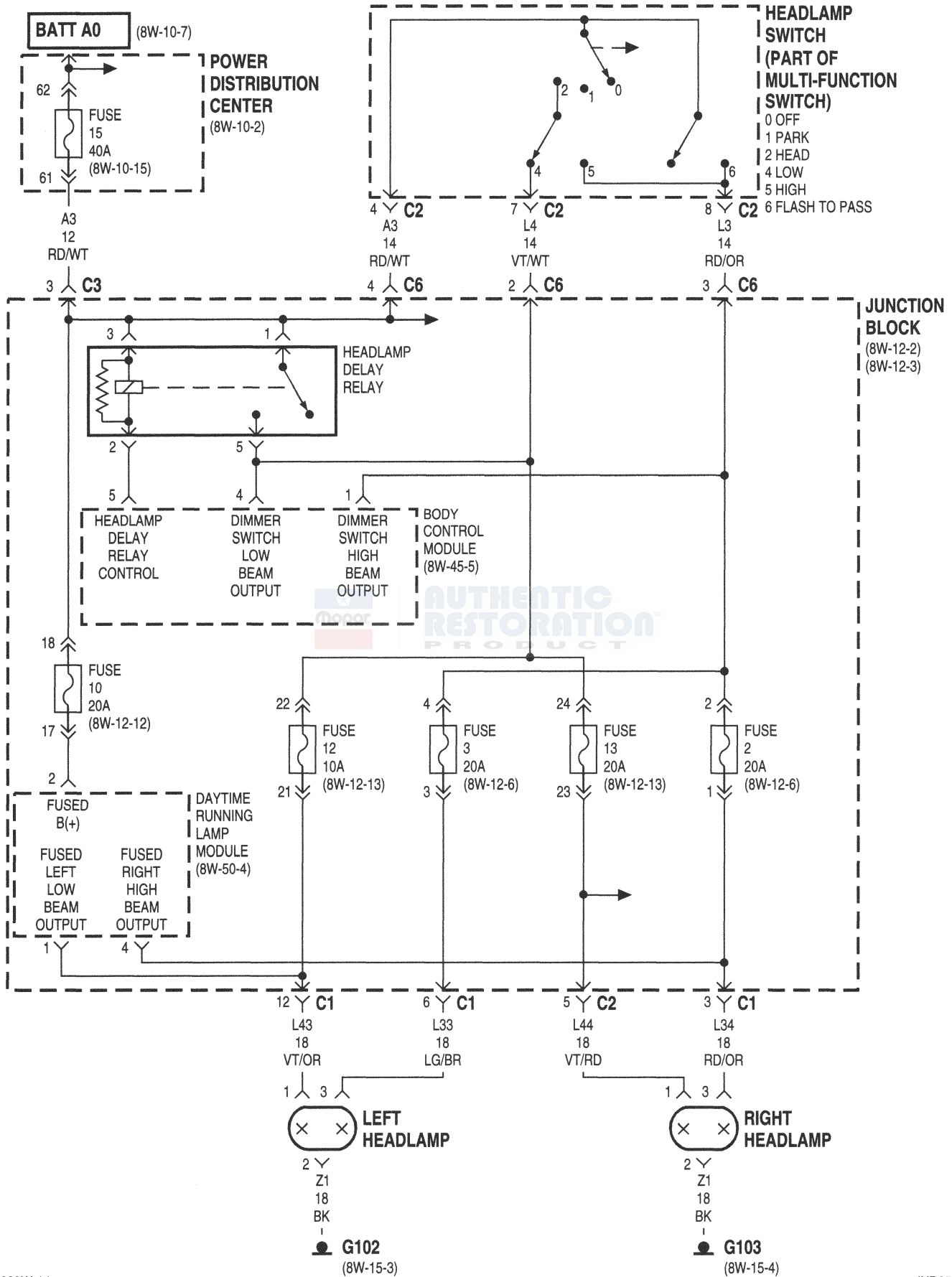


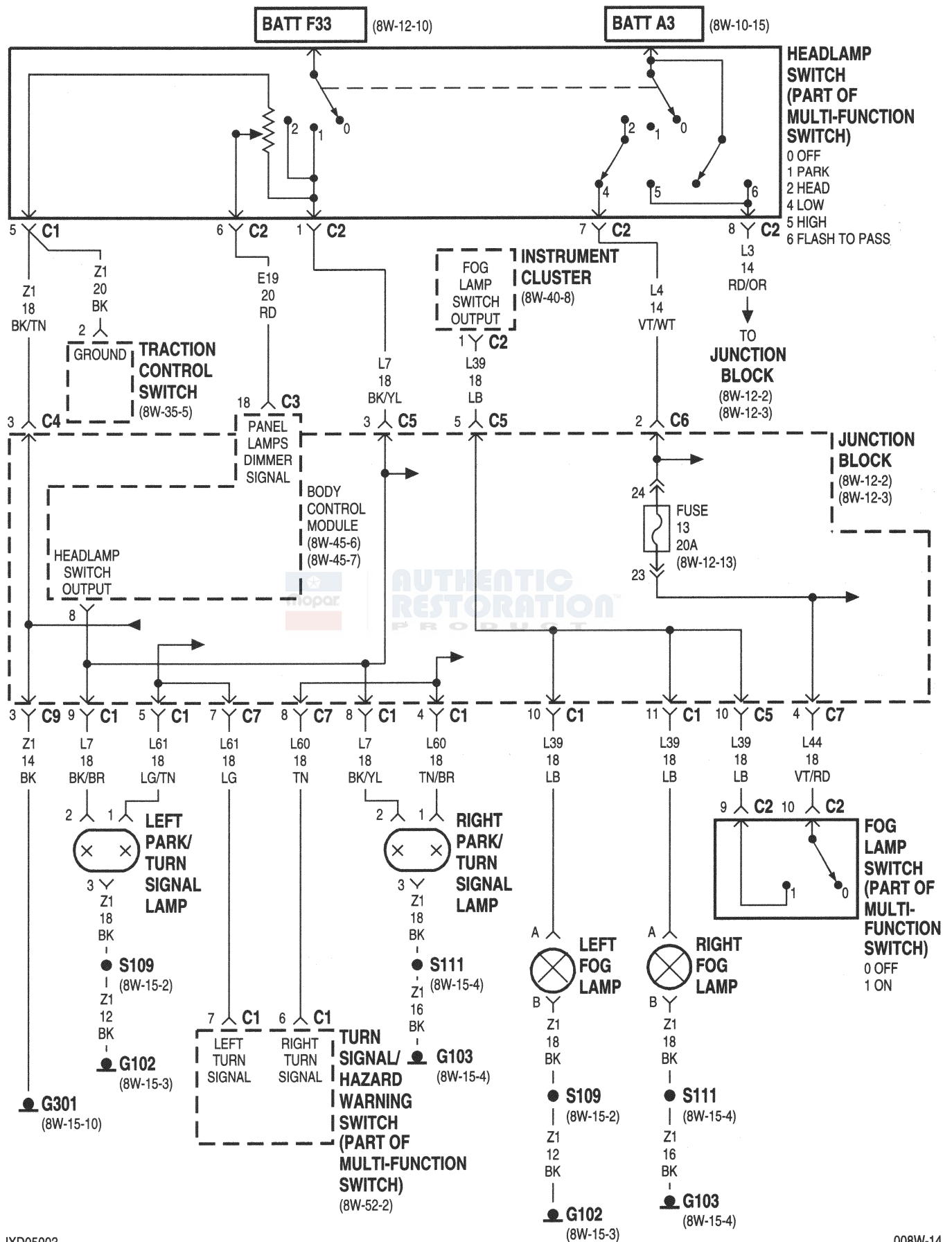
## **8W-50 FRONT LIGHTING**

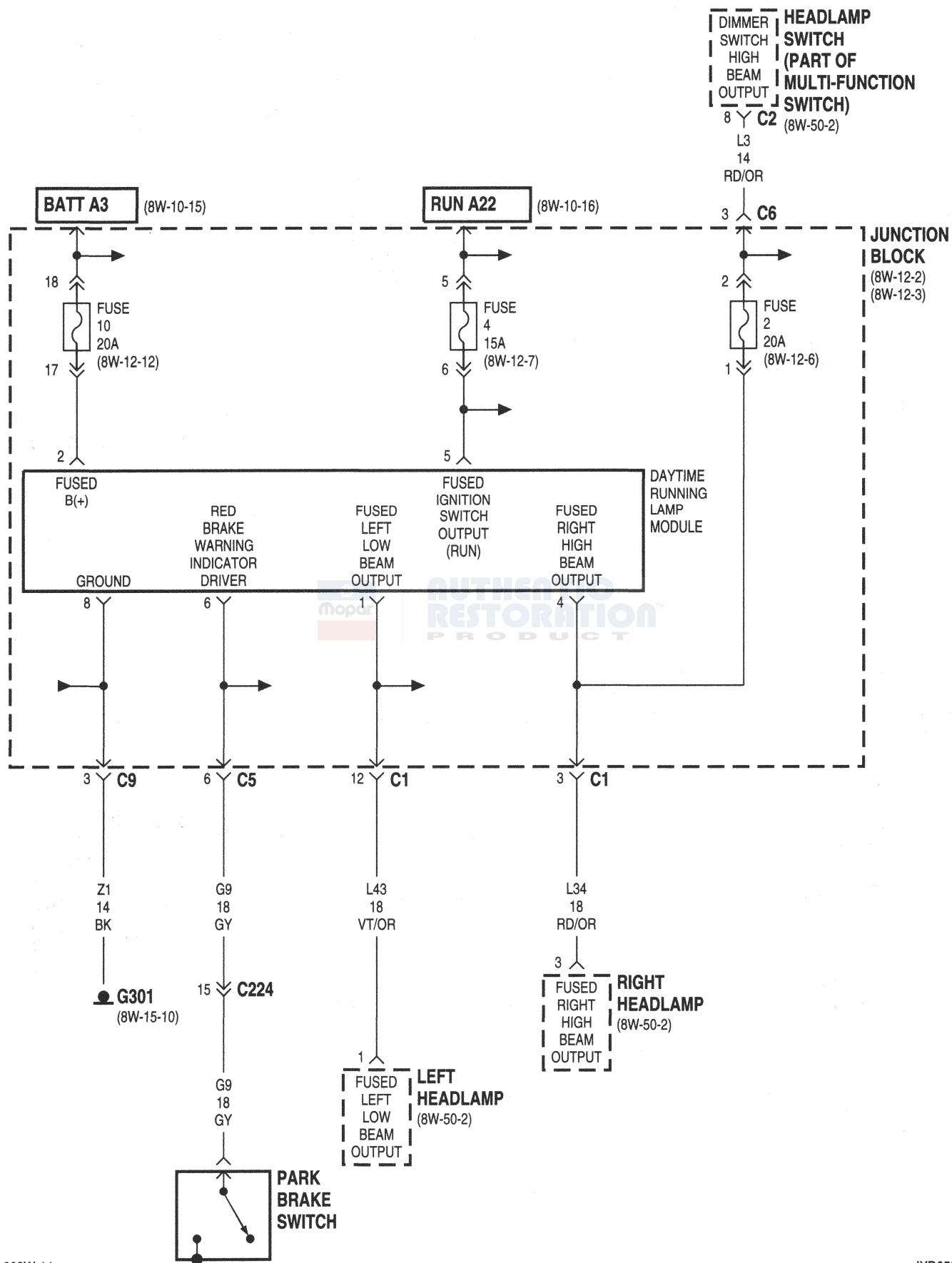
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Body Control Module .....	8W-50-2, 3	Headlamp Switch .....	8W-50-2, 3, 4
Daytime Running Lamp Module .....	8W-50-2, 4	Instrument Cluster .....	8W-50-3
Fog Lamp Switch .....	8W-50-3	Junction Block .....	8W-50-2, 3, 4
Fuse 2 (JB) .....	8W-50-2, 4	Left Fog Lamp .....	8W-50-3
Fuse 3 (JB) .....	8W-50-2	Left Headlamp .....	8W-50-2, 4
Fuse 4 (JB) .....	8W-50-4	Left Park/Turn Signal Lamp .....	8W-50-3
Fuse 10 (JB) .....	8W-50-2, 4	Park Brake Switch .....	8W-50-4
Fuse 12 (JB) .....	8W-50-2	Power Distribution Center .....	8W-50-2
Fuse 13 (JB) .....	8W-50-2, 3	Right Fog Lamp .....	8W-50-3
Fuse 15 (PDC) .....	8W-50-2	Right Headlamp .....	8W-50-2, 4
G102 .....	8W-50-2, 3	Right Park/Turn Signal Lamp .....	8W-50-3
G103 .....	8W-50-2, 3	Traction Control Switch .....	8W-50-3
G301 .....	8W-50-3, 4	Turn Signal/Hazard Warning Switch .....	8W-50-3
Headlamp Delay Relay .....	8W-50-2		



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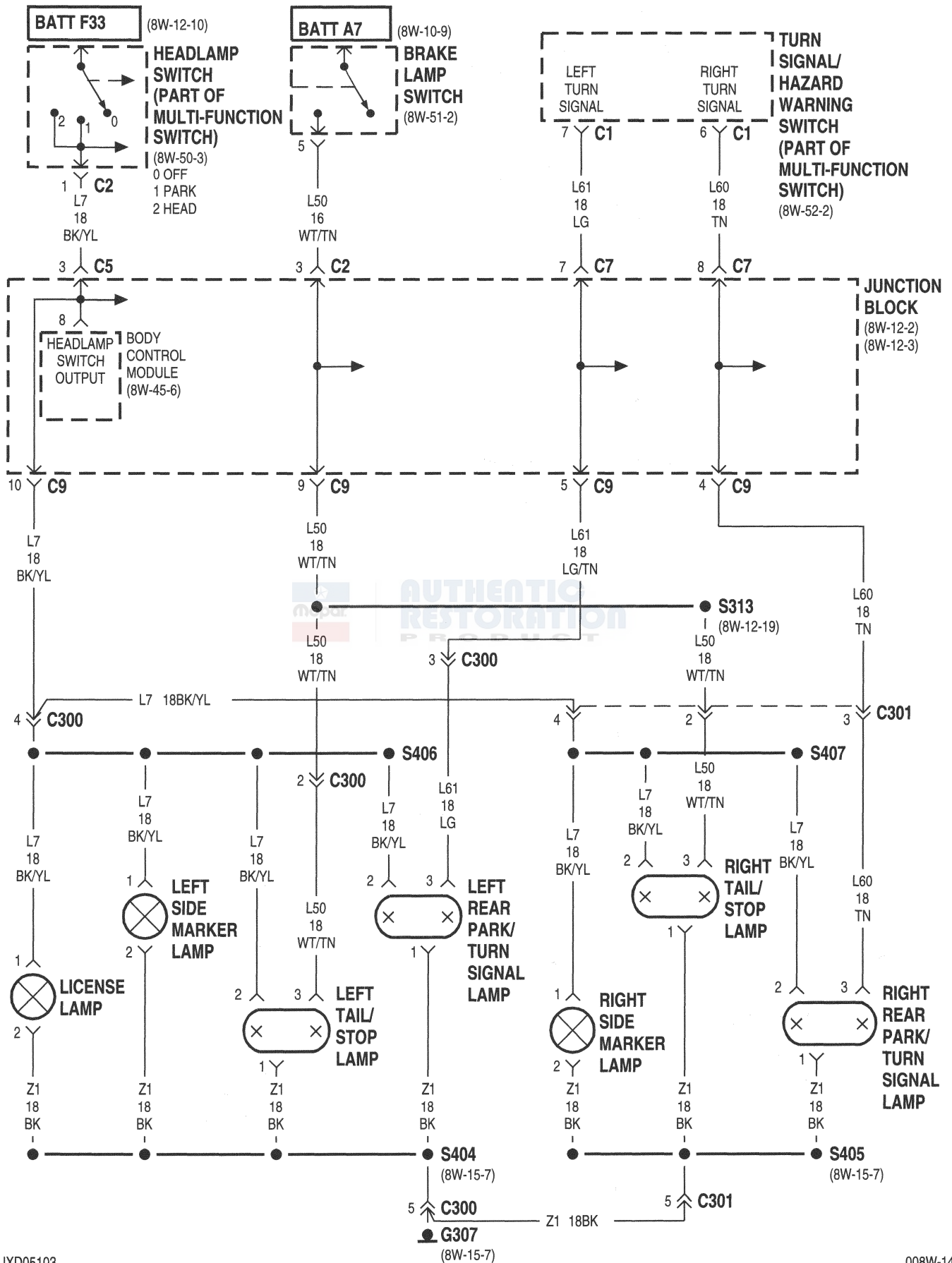
## **8W-51 REAR LIGHTING**

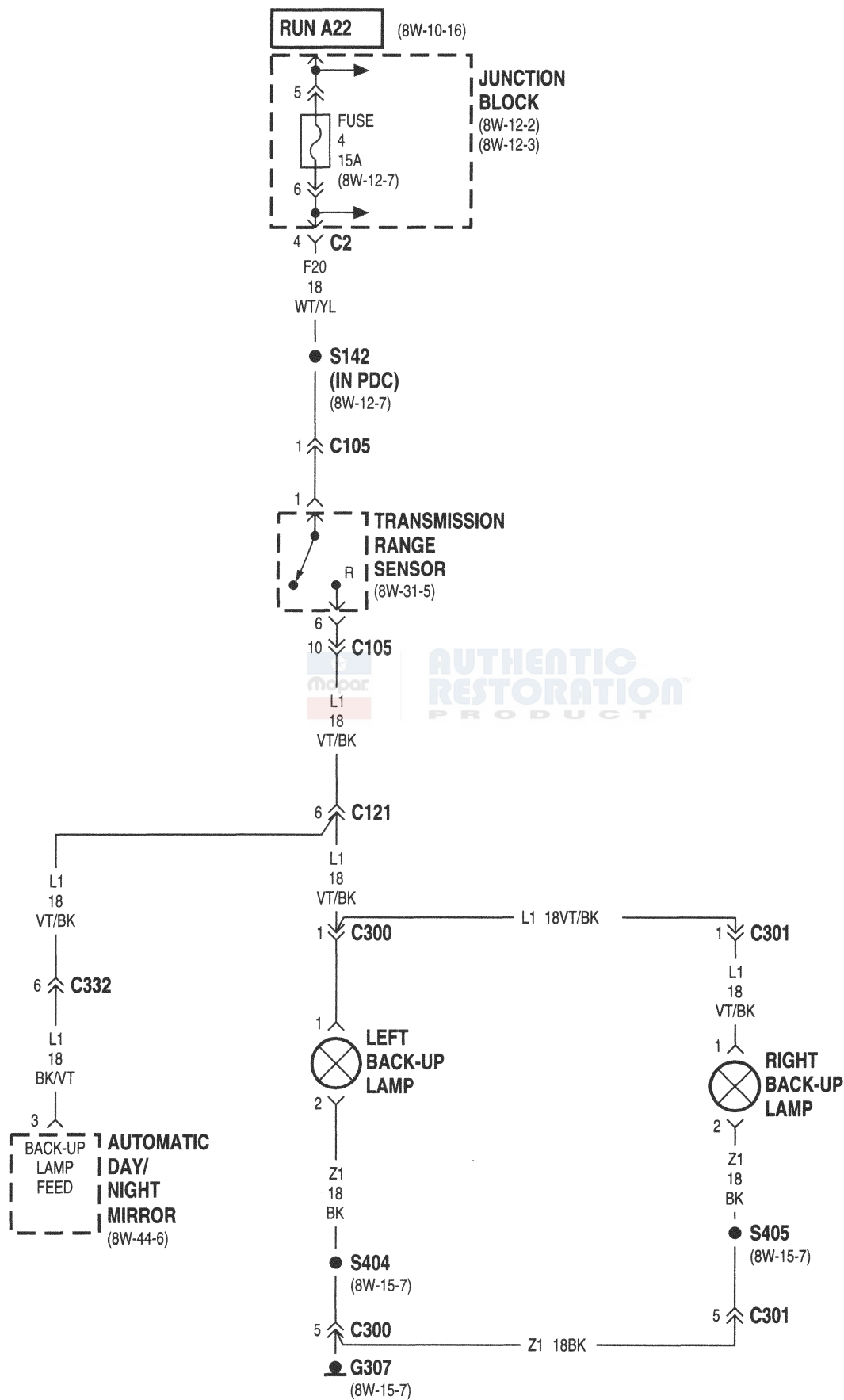
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Automatic Day/Night Mirror .....	8W-51-4	Left Rear Park/Turn Signal Lamp .....	8W-51-2, 3
Body Control Module .....	8W-51-3	Left Side Marker Lamp .....	8W-51-3
Brake Lamp Switch .....	8W-51-2, 3	Left Tail/Stop Lamp .....	8W-51-2, 3
Center High Mounted Stop Lamp .....	8W-51-2	License Lamp .....	8W-51-3
Combination Flasher .....	8W-51-2	Power Distribution Center .....	8W-51-2
Fuse 4 (JB) .....	8W-51-4	Right Back-Up Lamp .....	8W-51-4
Fuse 4 (PDC) .....	8W-51-2	Right Rear Park/Turn Signal Lamp ....	8W-51-2, 3
Fuse 6 (PDC) .....	8W-51-2	Right Side Marker Lamp .....	8W-51-3
G302 .....	8W-51-2	Right Tail/Stop Lamp .....	8W-51-2, 3
G307 .....	8W-51-2, 3, 4	Sentry Key Immobilizer Module .....	8W-51-2
Headlamp Switch .....	8W-51-3	Transmission Range Sensor .....	8W-51-4
Junction Block .....	8W-51-2, 3, 4	Turn Signal/Hazard Warning Switch ....	8W-51-2, 3
Left Back-Up Lamp .....	8W-51-4		



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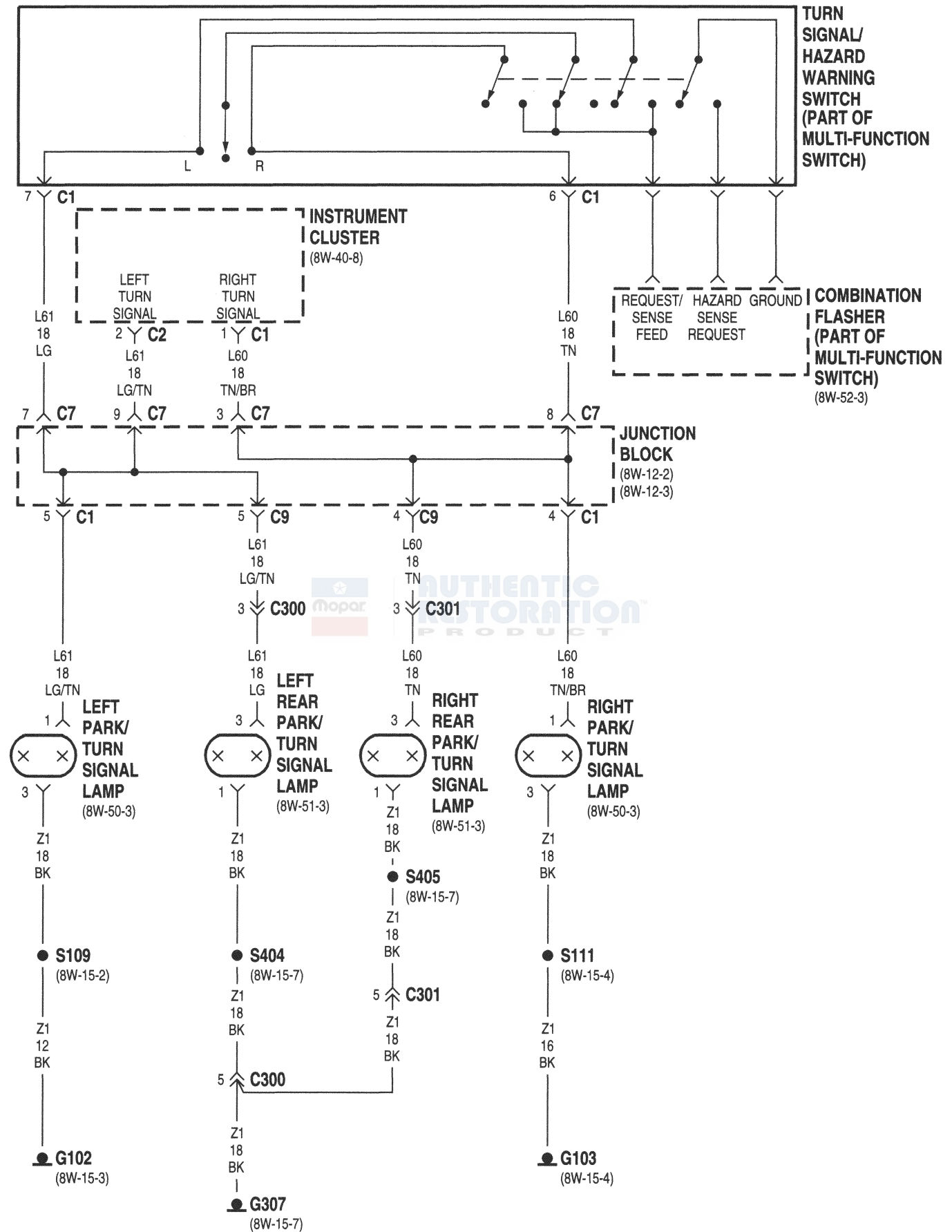


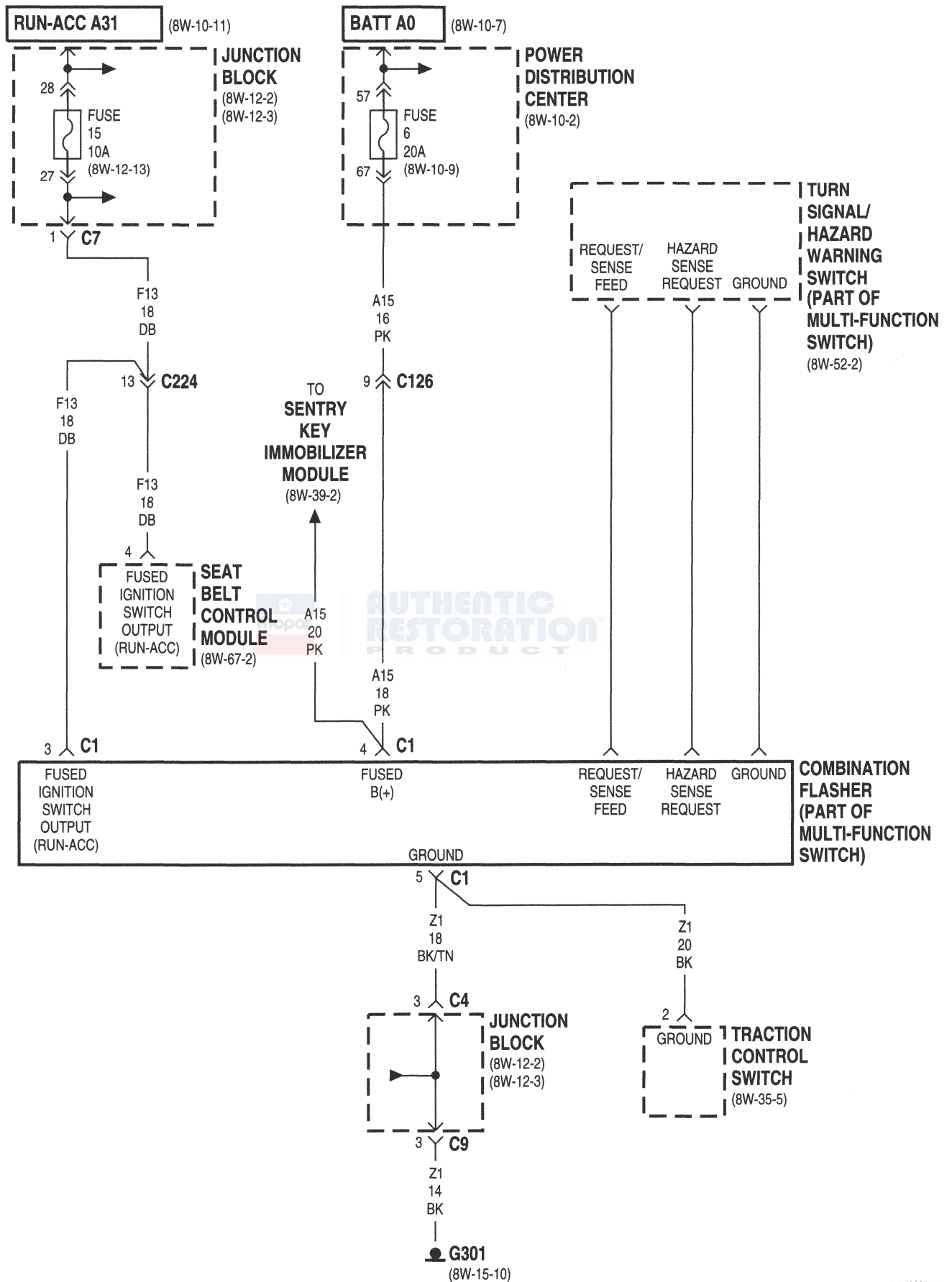
## **8W-52 TURN SIGNALS**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Combination Flasher .....	8W-52-2, 3	Left Park/Turn Signal Lamp .....	8W-52-2
Fuse 6 (PDC) .....	8W-52-3	Left Rear Park/Turn Signal Lamp .....	8W-52-2
Fuse 15 (JB) .....	8W-52-3	Power Distribution Center .....	8W-52-3
G102 .....	8W-52-2	Right Park/Turn Signal Lamp .....	8W-52-2
G103 .....	8W-52-2	Right Rear Park/Turn Signal Lamp .....	8W-52-2
G301 .....	8W-52-3	Seat Belt Control Module .....	8W-52-3
G307 .....	8W-52-2	Sentry Key Immobilizer Module .....	8W-52-3
Instrument Cluster .....	8W-52-2	Traction Control Switch .....	8W-52-3
Junction Block .....	8W-52-2, 3	Turn Signal/Hazard Warning Switch ....	8W-52-2, 3



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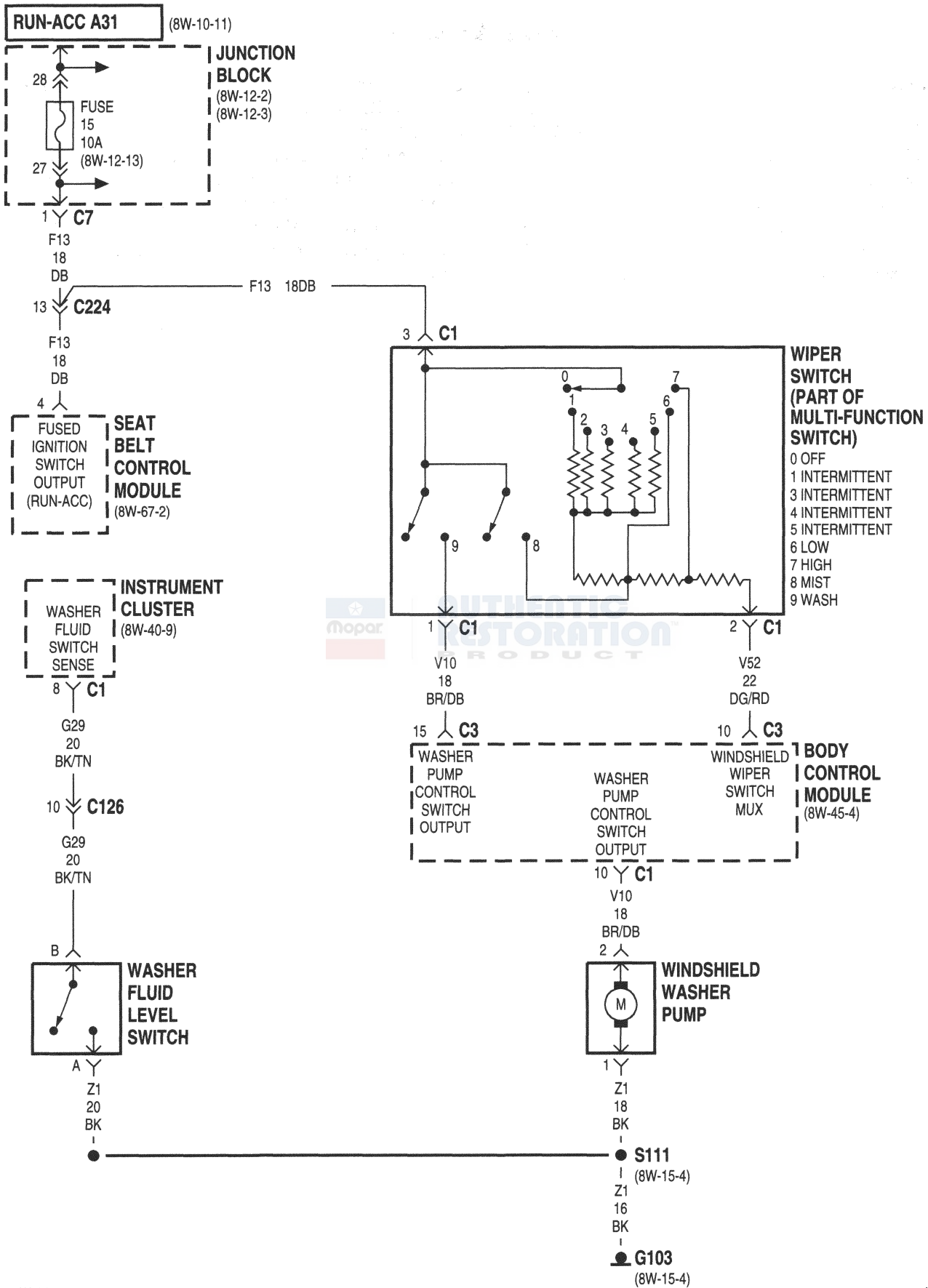
## **8W-53 WIPERS**

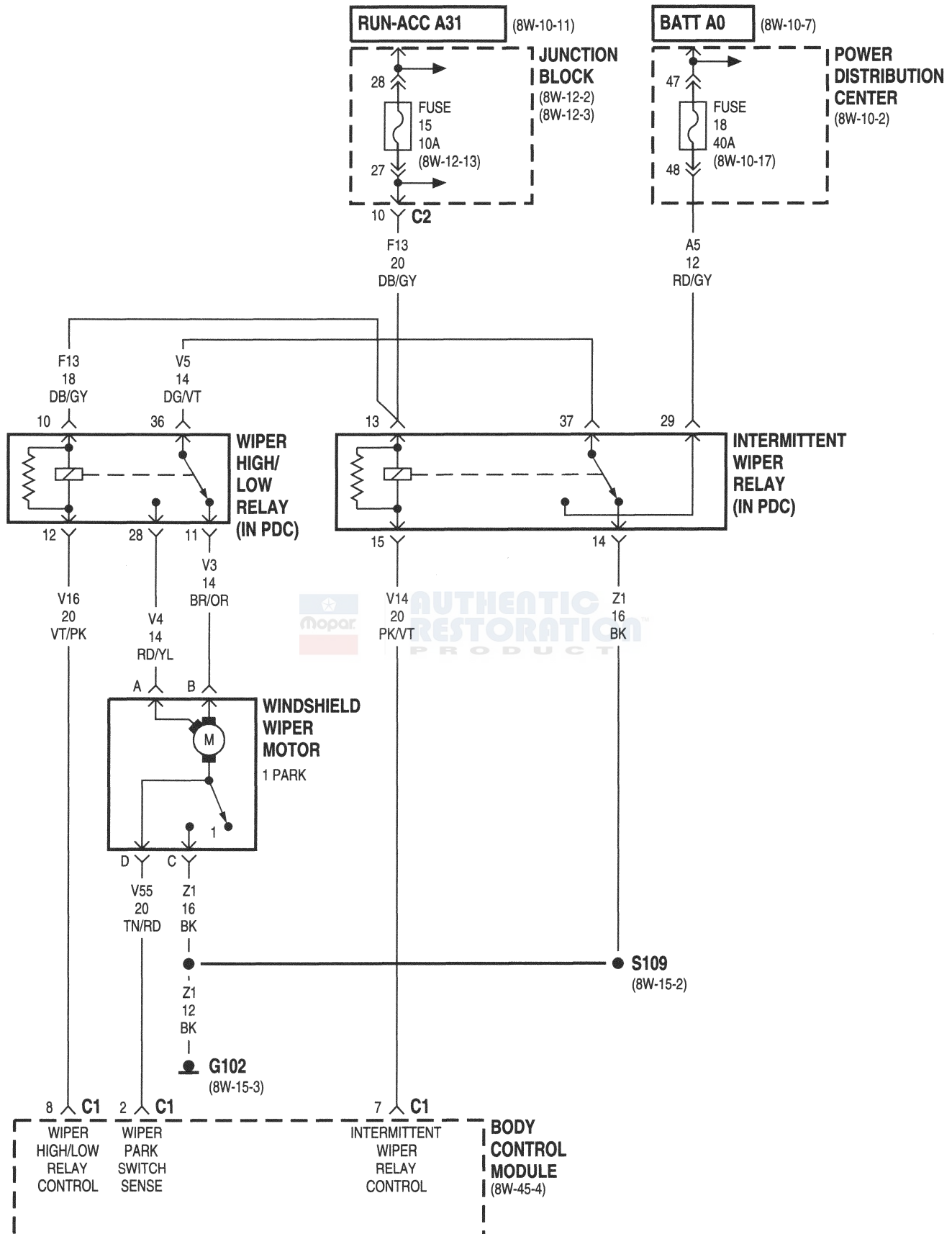
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Body Control Module .....	8W-53-2, 3	Junction Block .....	8W-53-2, 3
Fuse 15 (JB) .....	8W-53-2, 3	Power Distribution Center .....	8W-53-3
Fuse 15 (JB) .....	8W-53-3	Seat Belt Control Module .....	8W-53-2
Fuse 18 (PDC) .....	8W-53-3	Washer Fluid Level Switch .....	8W-53-2
G102 .....	8W-53-3	Windshield Washer Pump .....	8W-53-2
G103 .....	8W-53-2	Windshield Wiper Motor .....	8W-53-3
Instrument Cluster .....	8W-53-2	Wiper High/Low Relay .....	8W-53-3
Intermittent Wiper Relay .....	8W-53-3	Wiper Switch .....	8W-53-2



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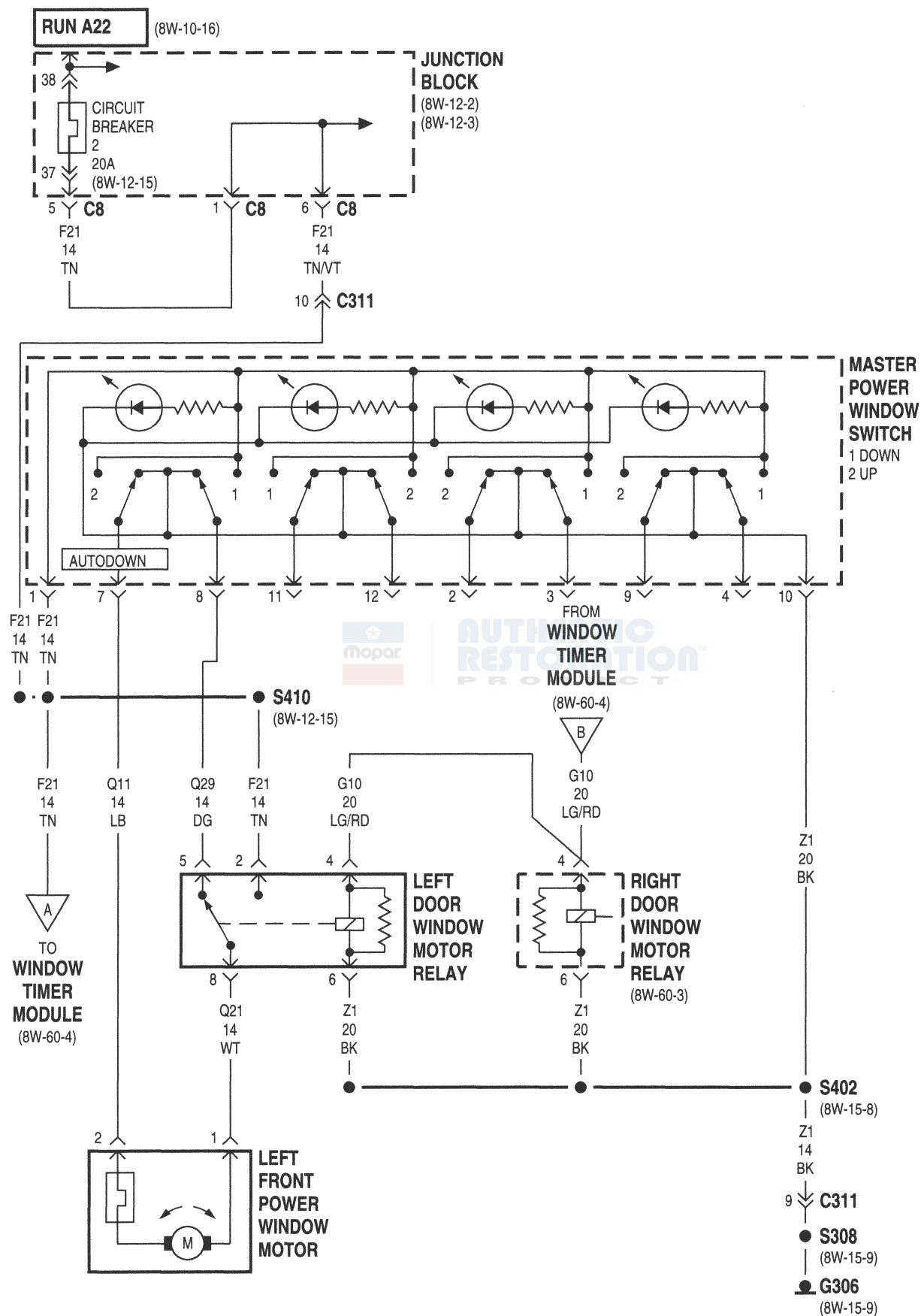


## **8W-60 POWER WINDOWS**

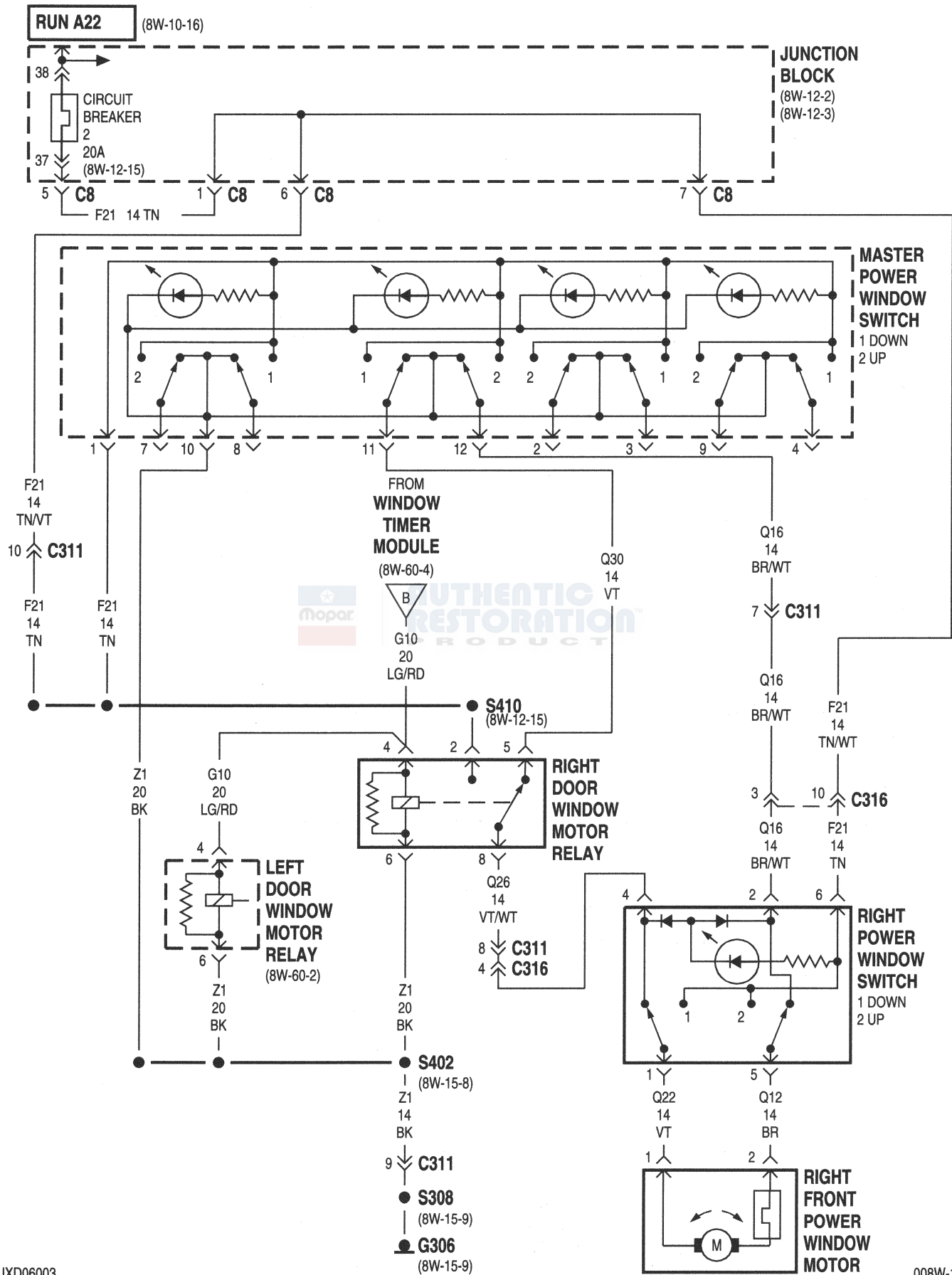
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Circuit Breaker 2 (JB) . . . . .	8W-60-2, 3	Power Top Switch . . . . .	8W-60-4
G306 . . . . .	8W-60-2, 3, 4	Right Door Window Motor Relay . . . . .	8W-60-2, 3
Junction Block . . . . .	8W-60-2, 3	Right Front Power Window Motor . . . . .	8W-60-3
Left Door Window Motor Relay . . . . .	8W-60-2, 3	Right Power Window Switch . . . . .	8W-60-3
Left Front Power Window Motor . . . . .	8W-60-2	Right Rear Power Window Motor . . . . .	8W-60-4
Left Rear Power Window Motor . . . . .	8W-60-4	Window Timer Module . . . . .	8W-60-4
Master Power Window Switch . . . . .	8W-60-2, 3, 4		

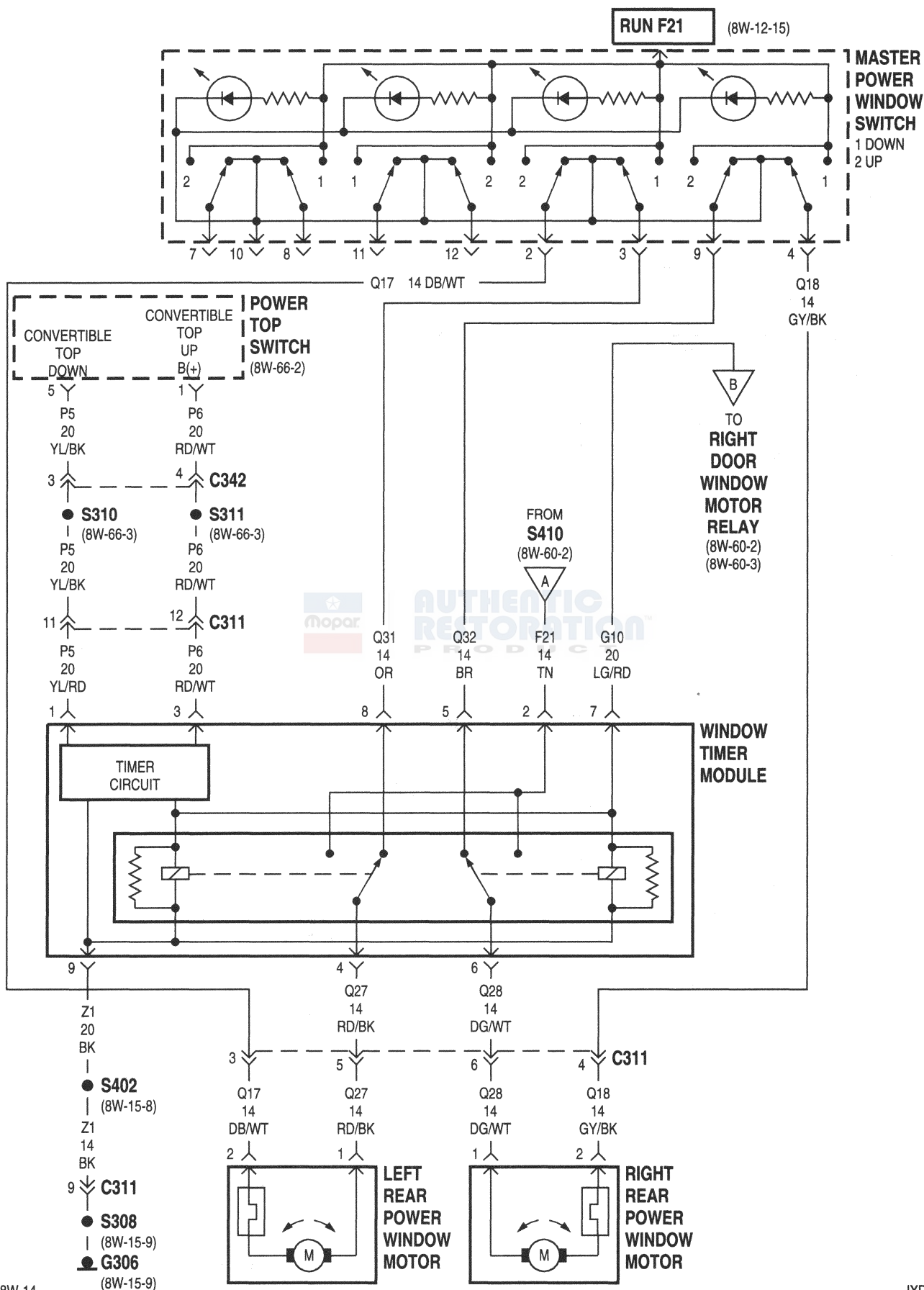


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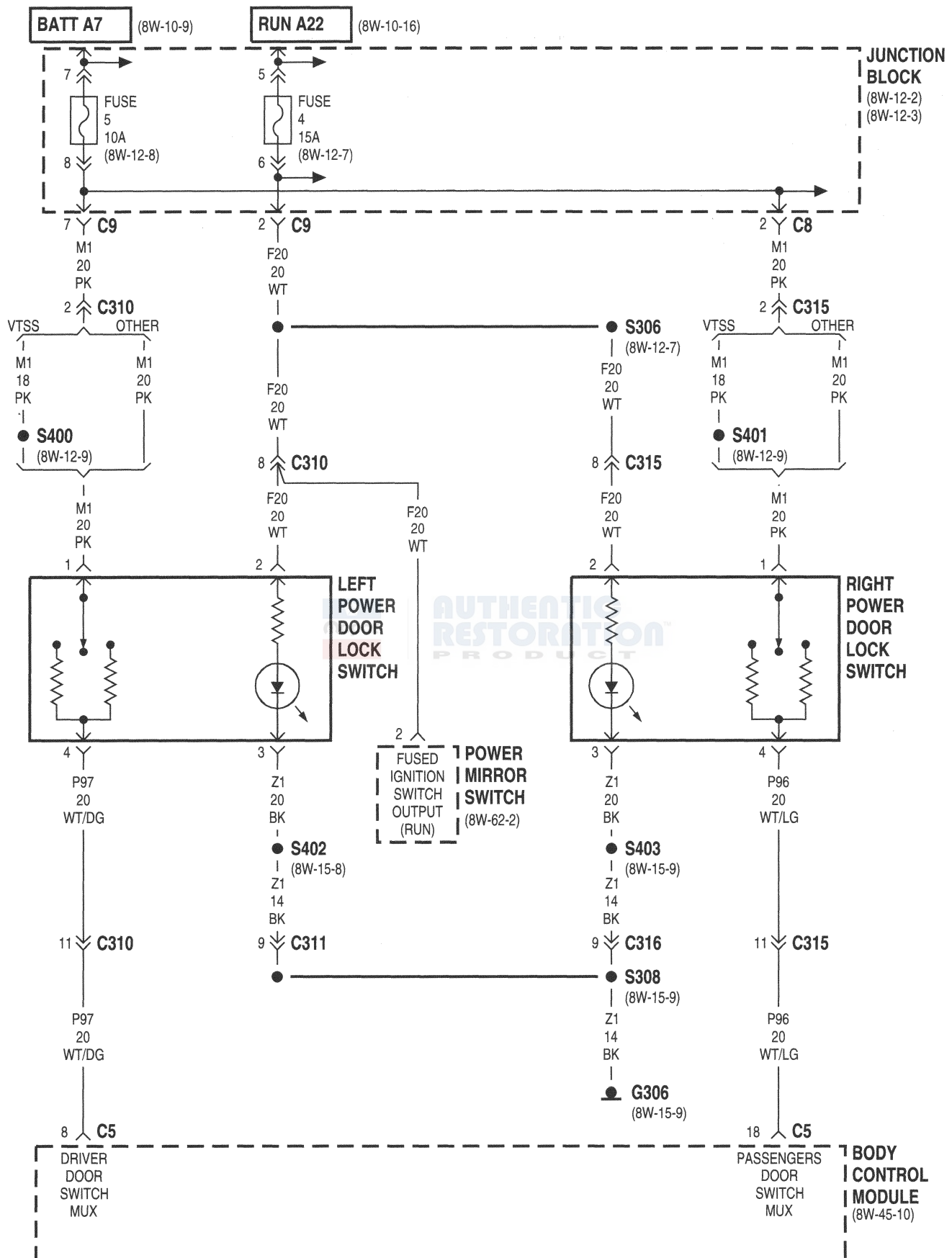




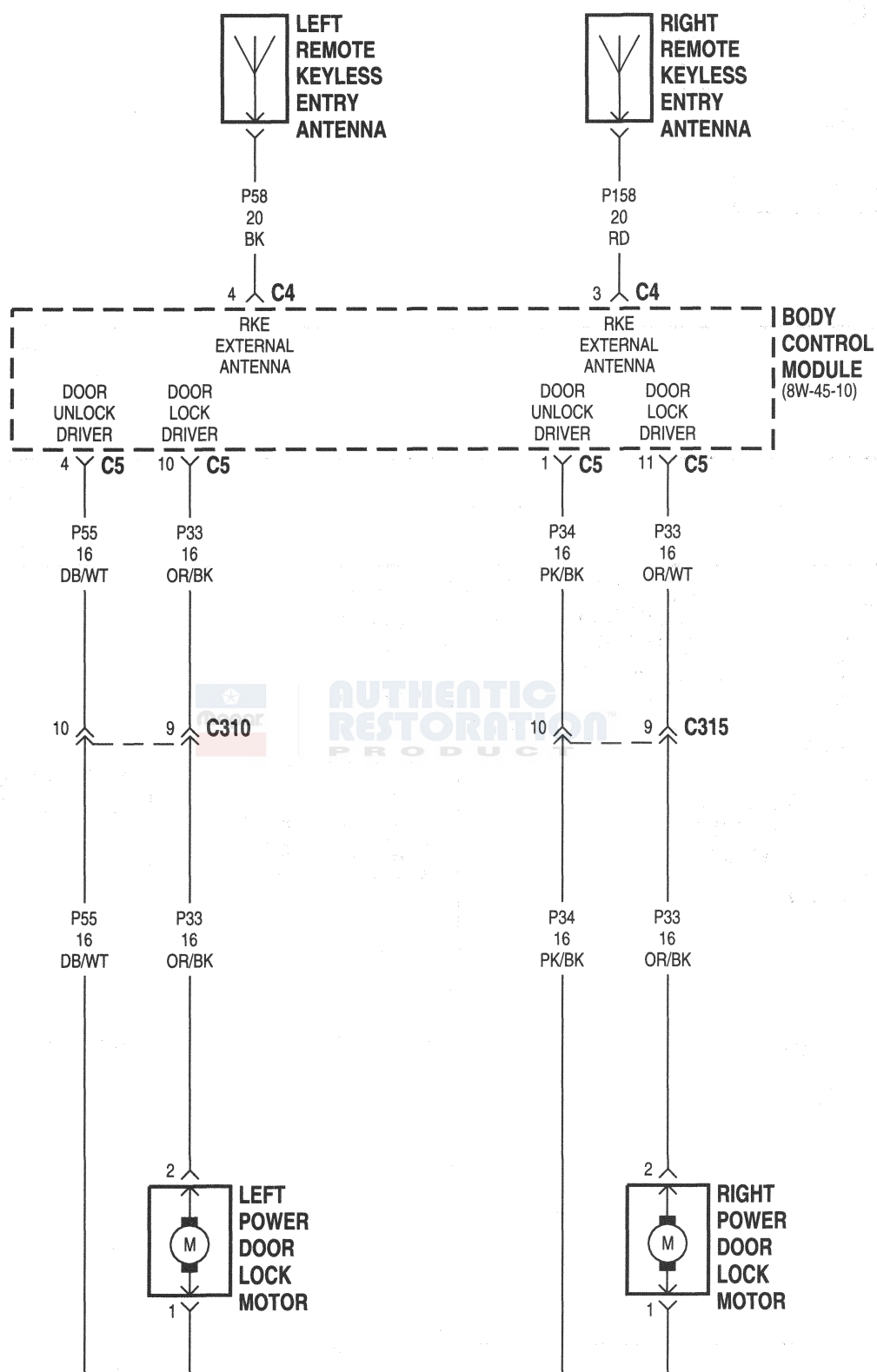
## **8W-61 POWER DOOR LOCKS**

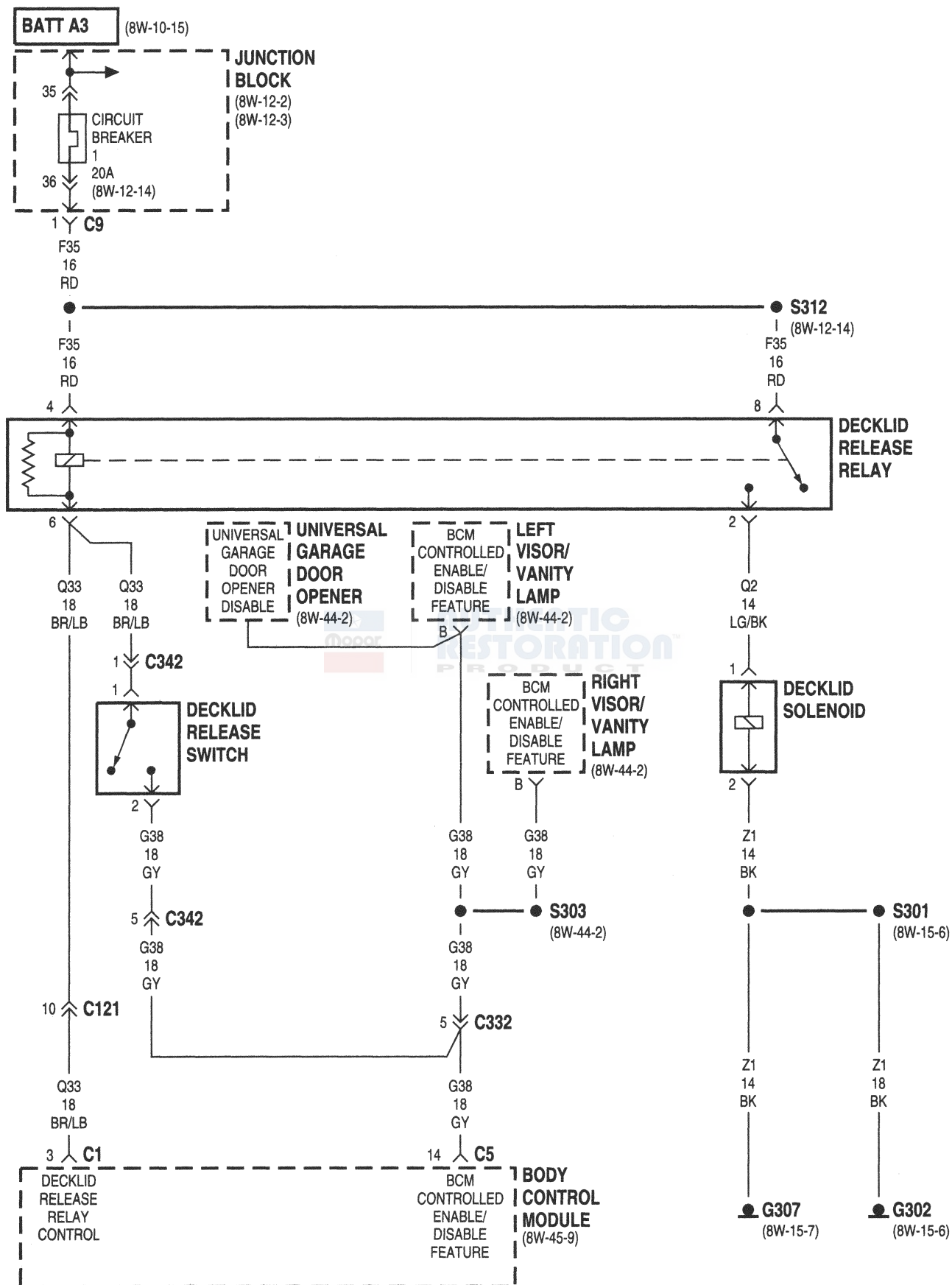
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Body Control Module . . . . .	8W-61-2, 3, 4	Left Power Door Lock Motor . . . . .	8W-61-3
Circuit Breaker 1 (JB) . . . . .	8W-61-4	Left Power Door Lock Switch . . . . .	8W-61-2
Decklid Release Relay . . . . .	8W-61-4	Left Remote Keyless Entry Antenna . . . . .	8W-61-3
Decklid Release Switch . . . . .	8W-61-4	Left Visor/Vanity Lamp . . . . .	8W-61-4
Decklid Solenoid . . . . .	8W-61-4	Power Mirror Switch . . . . .	8W-61-2
Fuse 4 (JB) . . . . .	8W-61-2	Right Power Door Lock Motor . . . . .	8W-61-3
Fuse 5 (JB) . . . . .	8W-61-2	Right Power Door Lock Switch . . . . .	8W-61-2
G302 . . . . .	8W-61-4	Right Remote Keyless Entry Antenna . . . . .	8W-61-3
G306 . . . . .	8W-61-2	Right Visor/Vanity Lamp . . . . .	8W-61-4
G307 . . . . .	8W-61-4	Universal Garage Door Opener . . . . .	8W-61-4
Junction Block . . . . .	8W-61-2, 4		









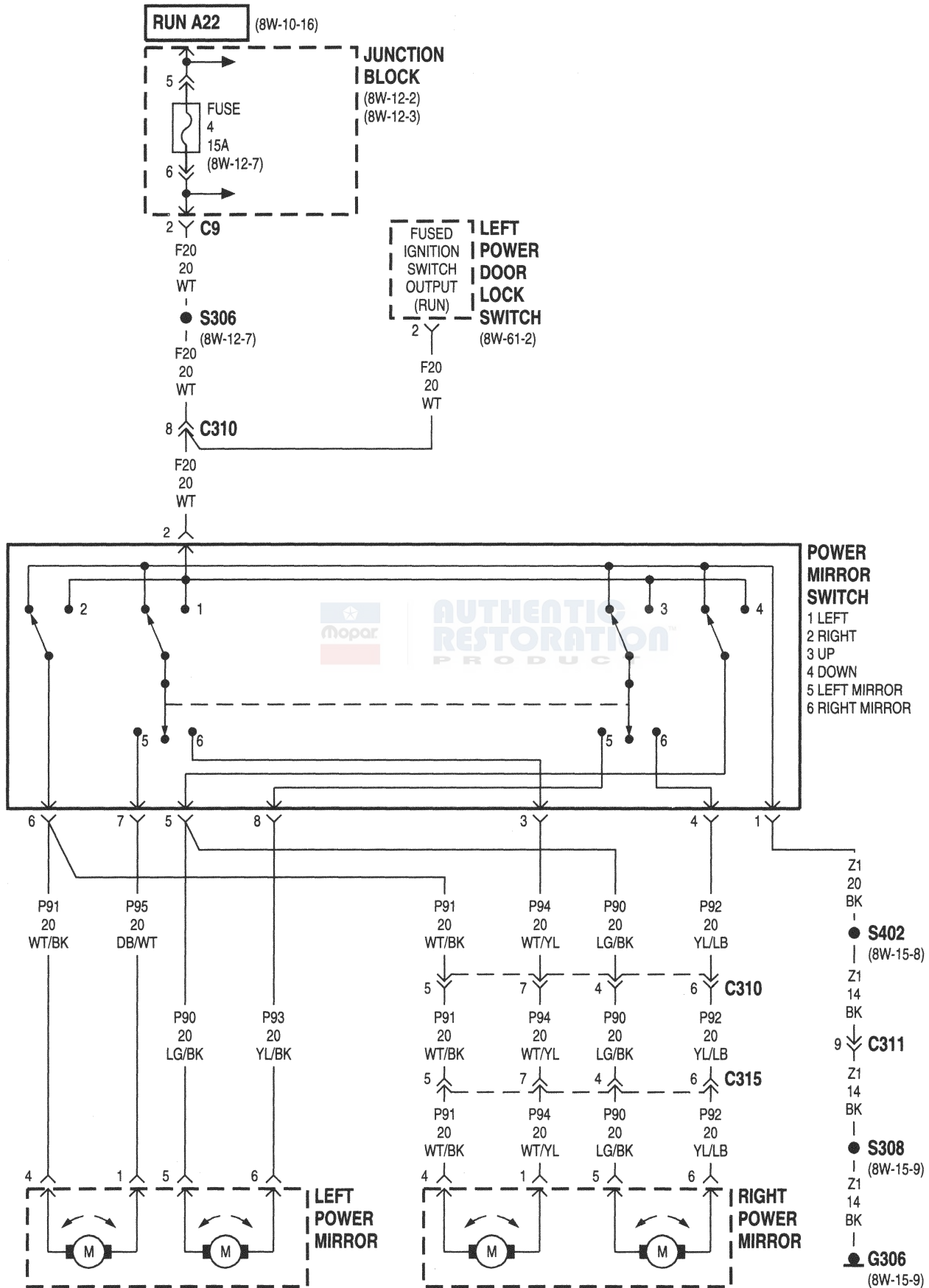


**8W-62 POWER MIRRORS**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Fuse 4 (JB) .....	8W-62-2	Left Power Mirror .....	8W-62-2
G306 .....	8W-62-2	Power Mirror Switch .....	8W-62-2
Junction Block .....	8W-62-2	Right Power Mirror .....	8W-62-2
Left Power Door Lock Switch .....	8W-62-2		



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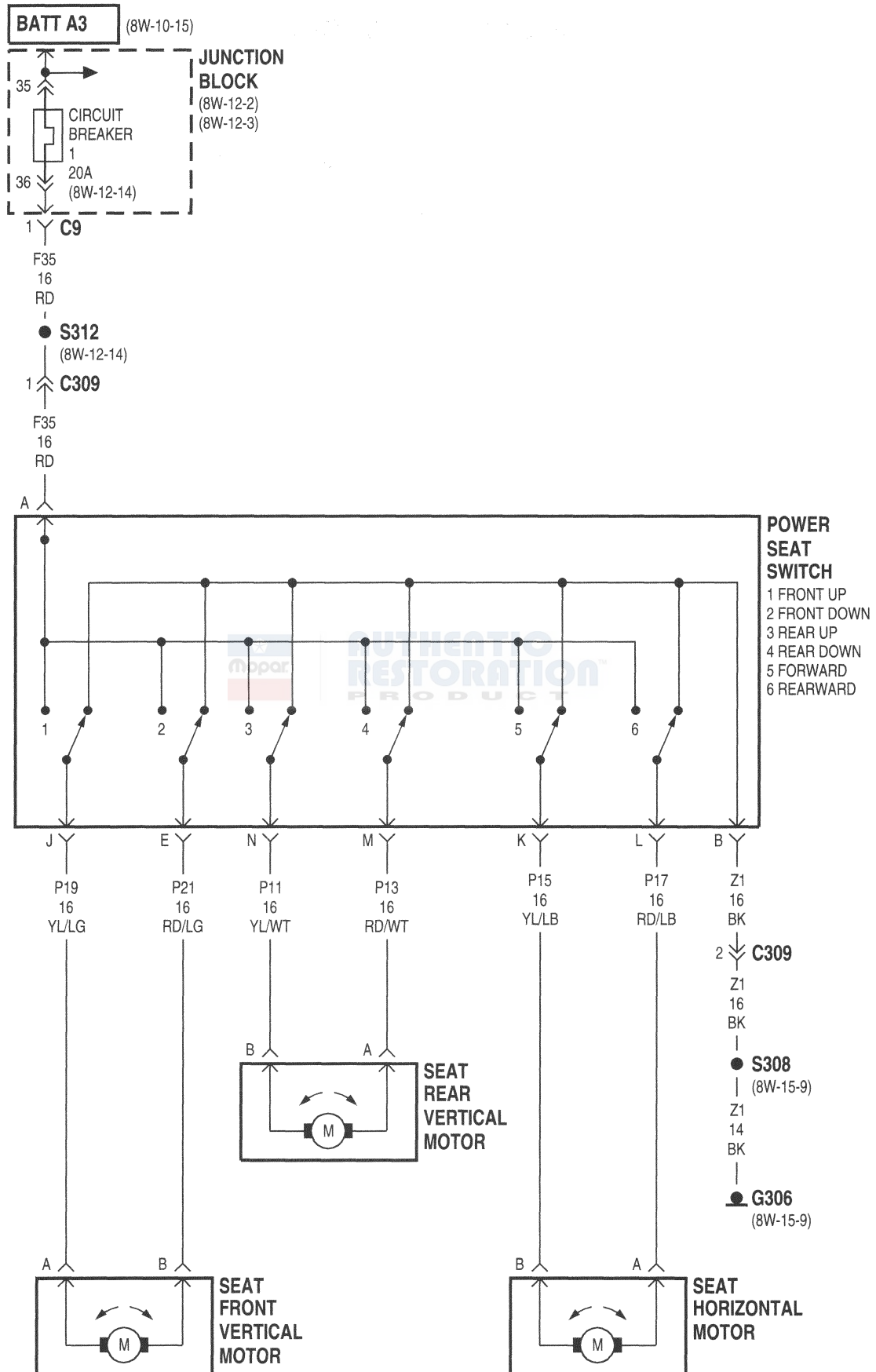


## **8W-63 POWER SEAT**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Circuit Breaker 1 (JB) .....	8W-63-2	Seat Front Vertical Motor .....	8W-63-2
G306 .....	8W-63-2	Seat Horizontal Motor .....	8W-63-2
Junction Block .....	8W-63-2	Seat Rear Vertical Motor .....	8W-63-2
Power Seat Switch .....	8W-63-2		



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## **8W-66 POWER TOP**

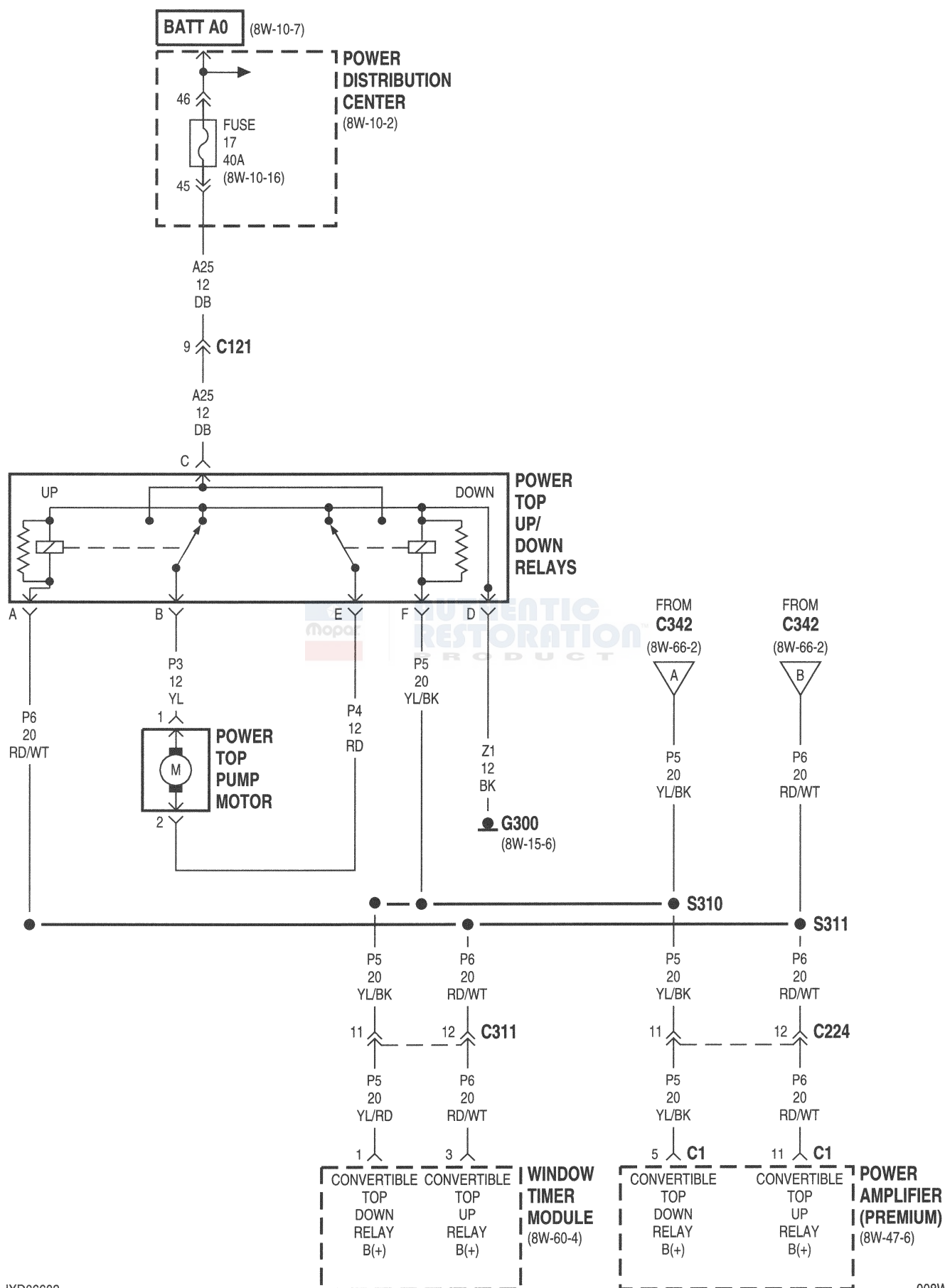
<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Body Control Module .....	8W-66-2	Power Distribution Center .....	8W-66-3
Fuse 4 (JB) .....	8W-66-2	Power Top Pump Motor .....	8W-66-3
Fuse 17 (PDC) .....	8W-66-3	Power Top Relay .....	8W-66-2
G300 .....	8W-66-3	Power Top Switch .....	8W-66-2
G306 .....	8W-66-2	Power Top Up/Down Relays .....	8W-66-3
Junction Block .....	8W-66-2	PRNDL Illumination LED .....	8W-66-2
Power Amplifier .....	8W-66-3	Window Timer Module .....	8W-66-3



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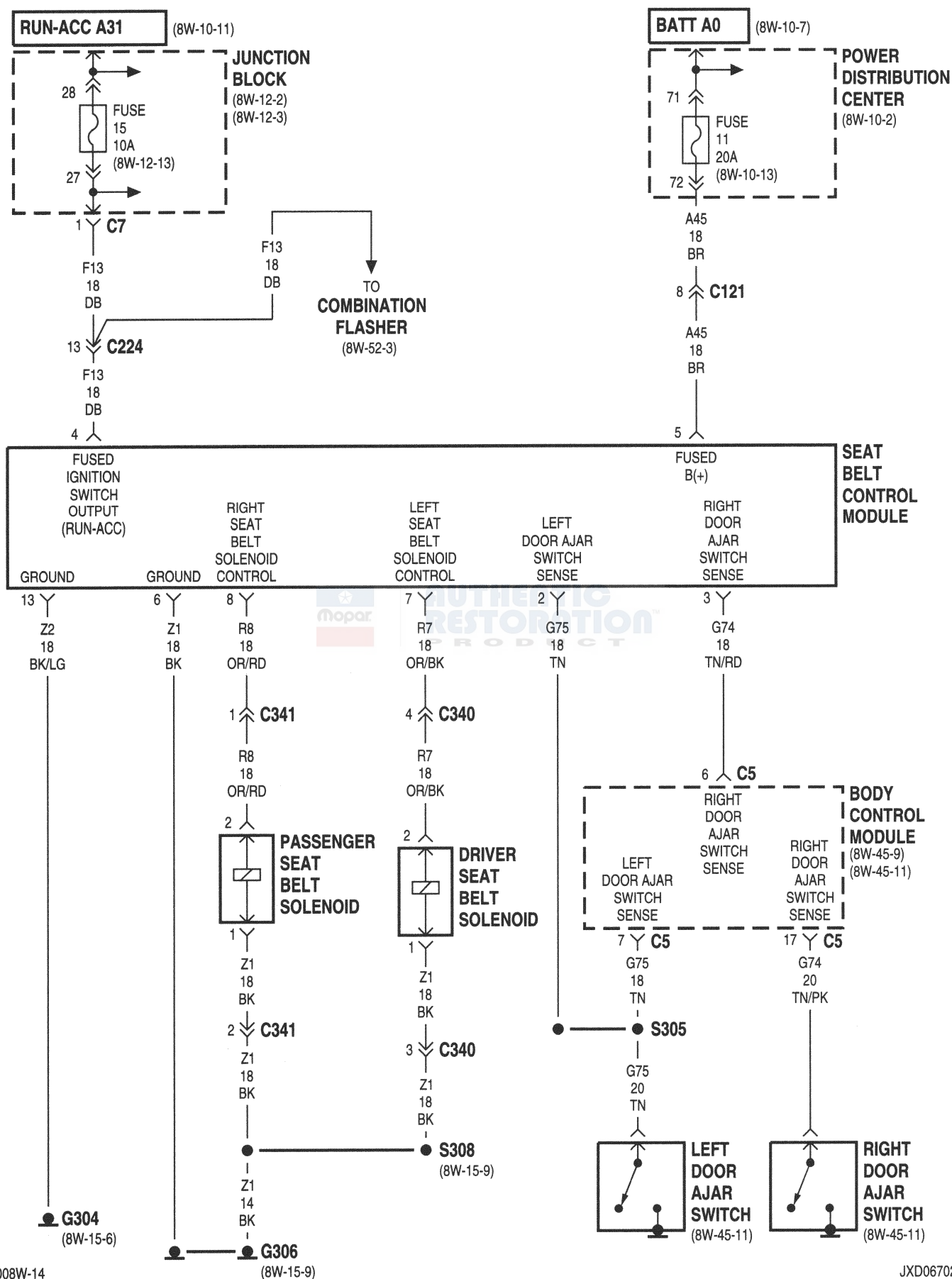


## **8W-67 RESTRAINT SYSTEM**

<b>Component</b>	<b>Page</b>	<b>Component</b>	<b>Page</b>
Body Control Module .....	8W-67-2	Junction Block .....	8W-67-2
Combination Flasher .....	8W-67-2	Left Door Ajar Switch .....	8W-67-2
Driver Seat Belt Solenoid .....	8W-67-2	Passenger Seat Belt Solenoid .....	8W-67-2
Fuse 11 (PDC) .....	8W-67-2	Power Distribution Center .....	8W-67-2
Fuse 15 (JB) .....	8W-67-2	Right Door Ajar Switch .....	8W-67-2
G304 .....	8W-67-2	Seat Belt Control Module .....	8W-67-2
G306 .....	8W-67-2		



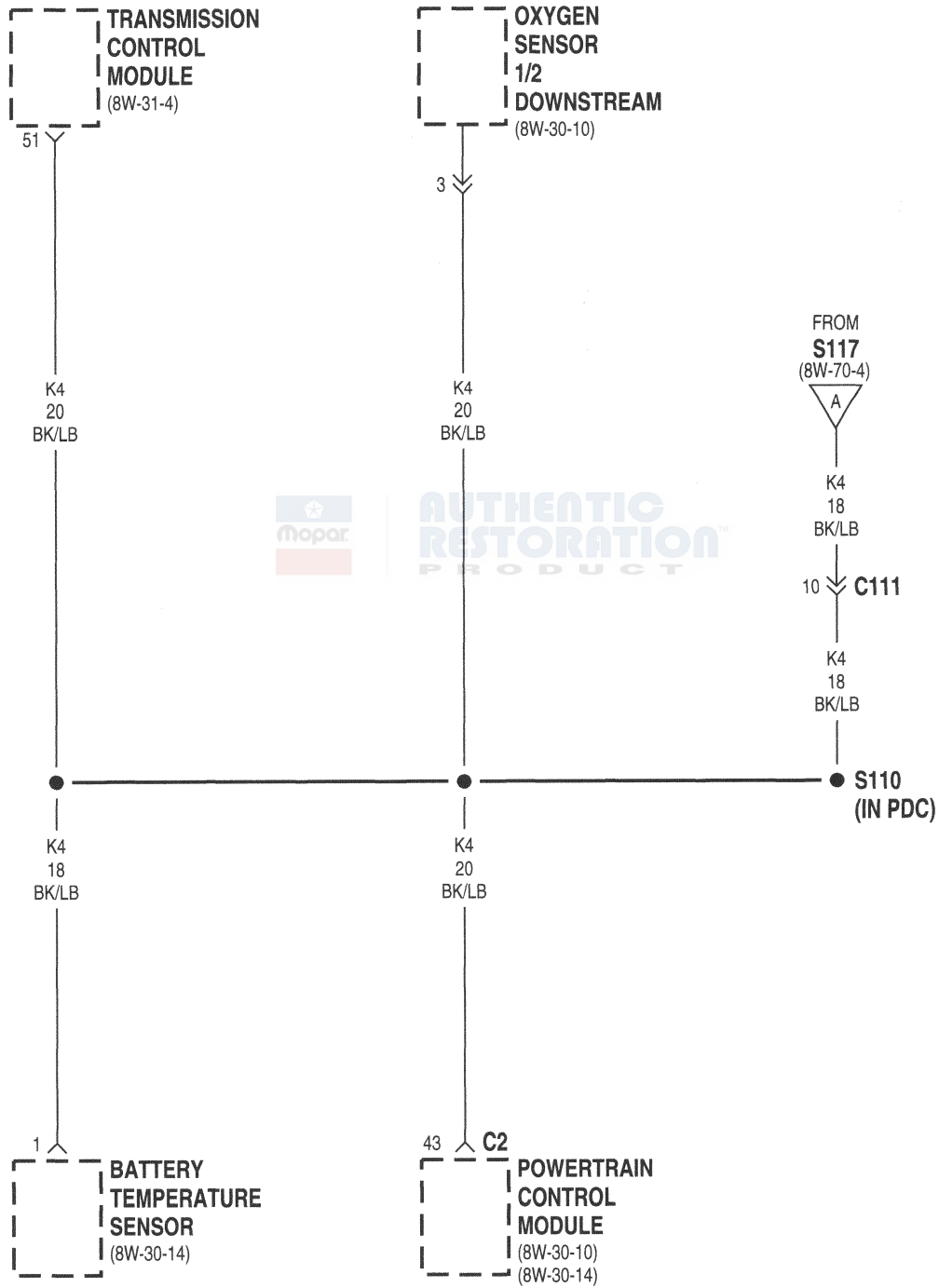
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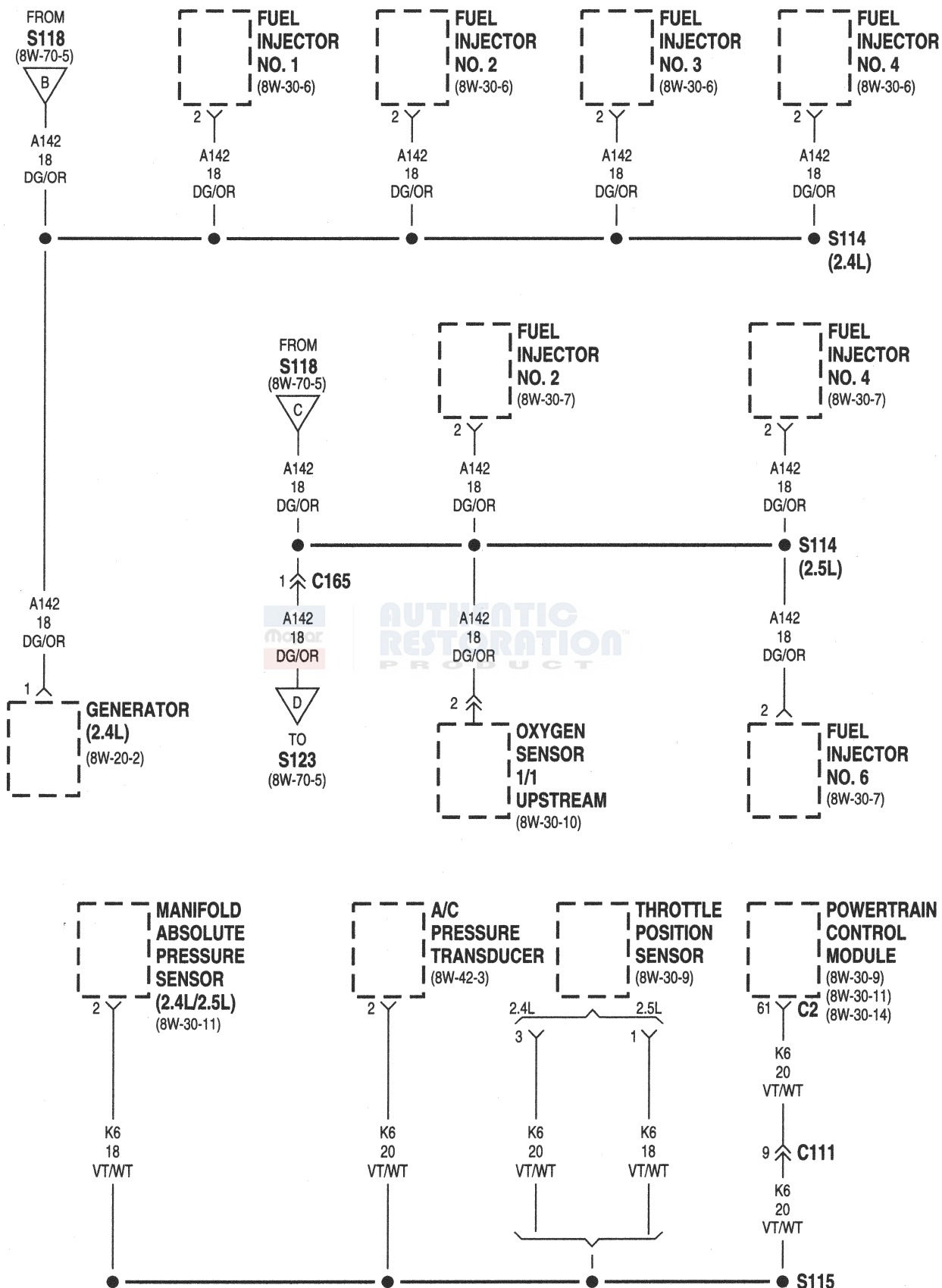


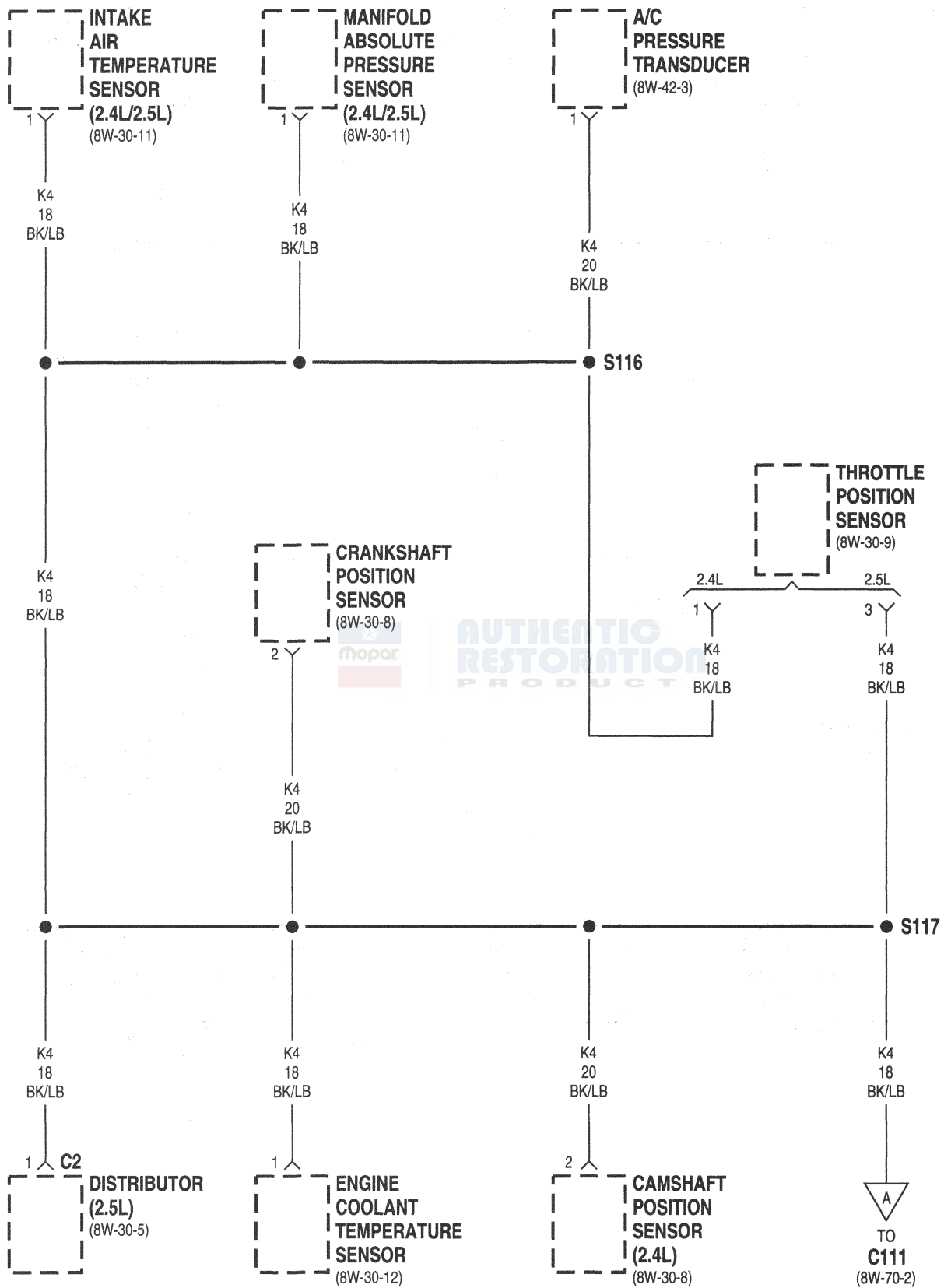
## 8W-70 SPLICE INFORMATION

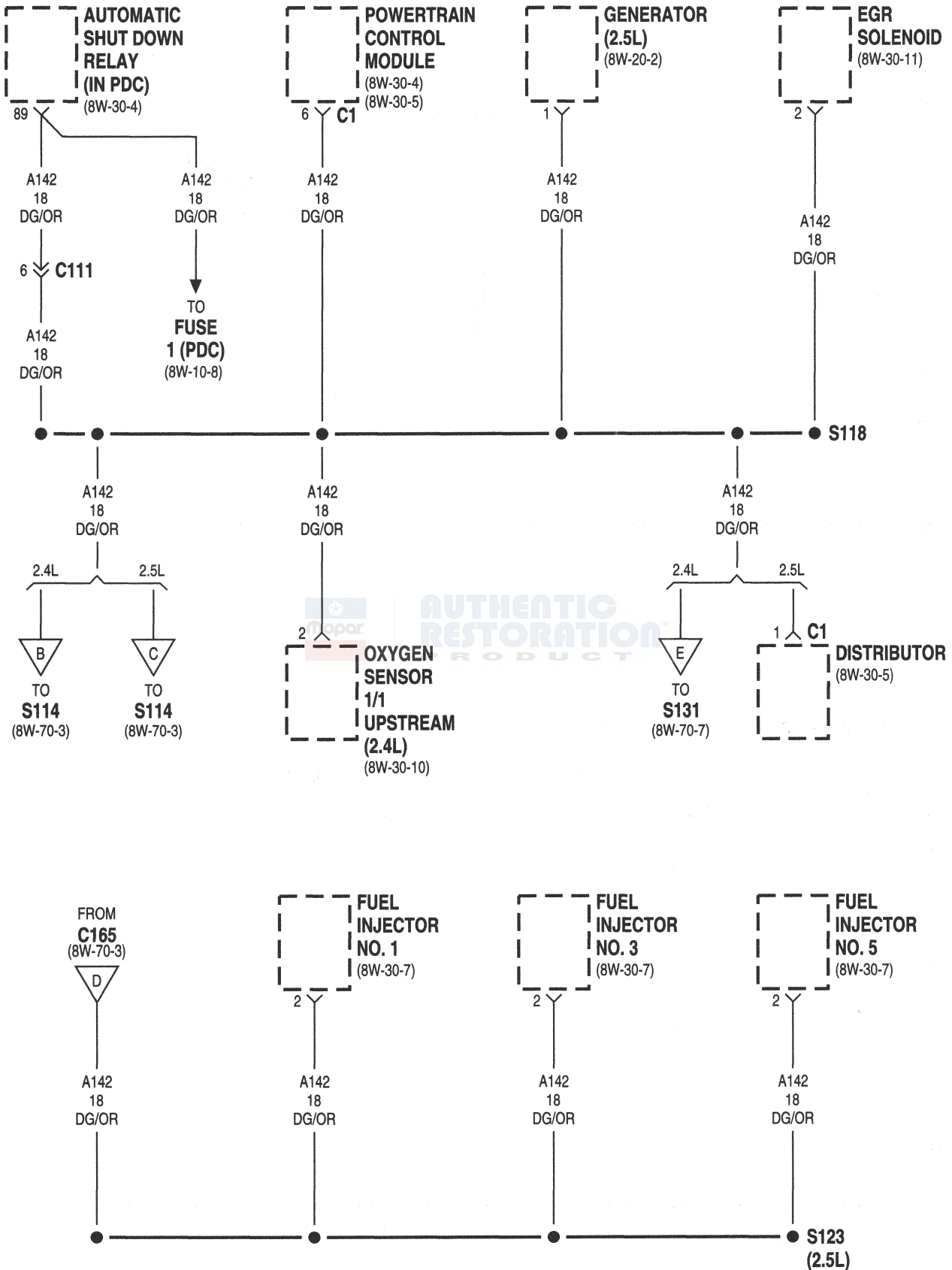
Component	Page	Component	Page
S100 .....	8W-10-8	S200 .....	8W-15-5
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S102 .....	8W-10-10	S202 .....	8W-45-3
S103 .....	8W-10-17	S203 .....	8W-12-8
S104 .....	8W-10-9	S204 .....	8W-10-12
S105 .....	8W-10-13	S301 .....	8W-15-6
S106 .....	8W-10-12	S302 .....	8W-12-8
S109 .....	8W-15-2	S303 .....	8W-44-2
S110 .....	8W-70-2	S305 .....	8W-67-2
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S113 .....	8W-20-2	S307 .....	8W-70-7
S114 .....	8W-70-3	S308 .....	8W-15-9
S115 .....	8W-70-3	S310 .....	8W-66-3
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S127 .....	8W-30-17	S405 .....	8W-15-7
S131 .....	8W-70-7	S406 .....	8W-12-17
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S141 .....	8W-45-3	S410 .....	8W-12-15
S142 .....	8W-12-7		



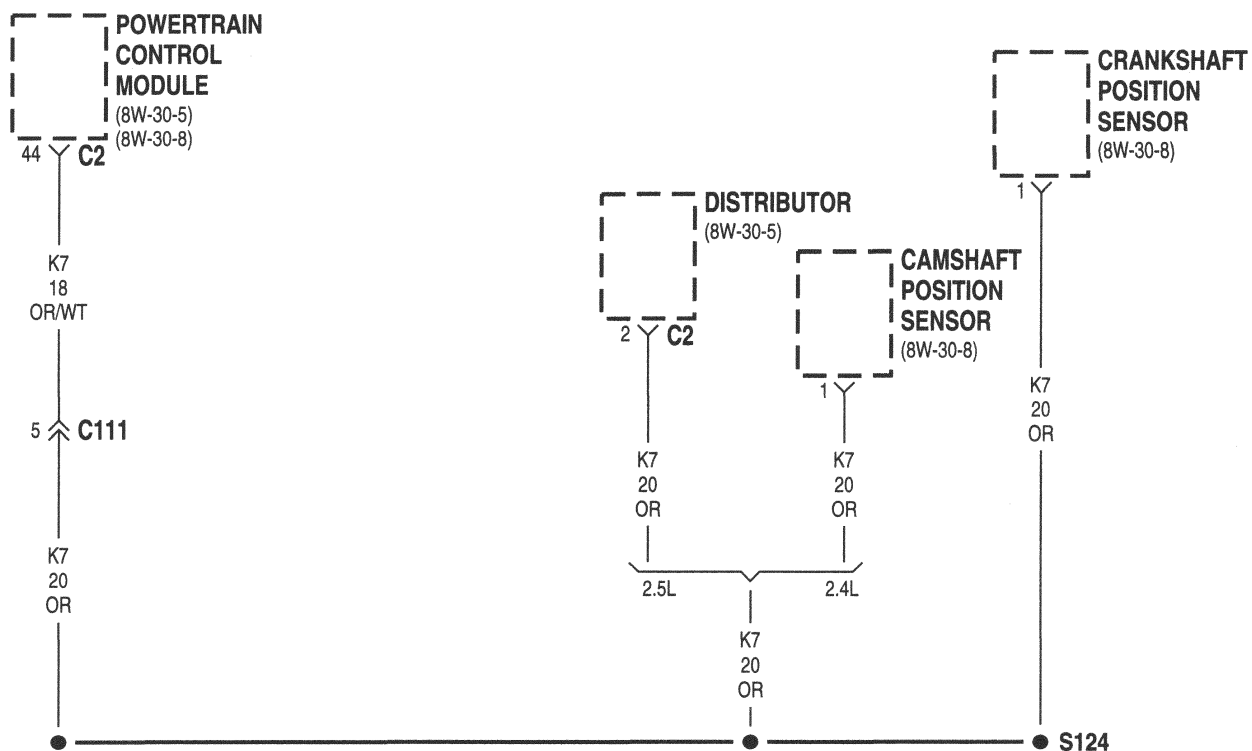




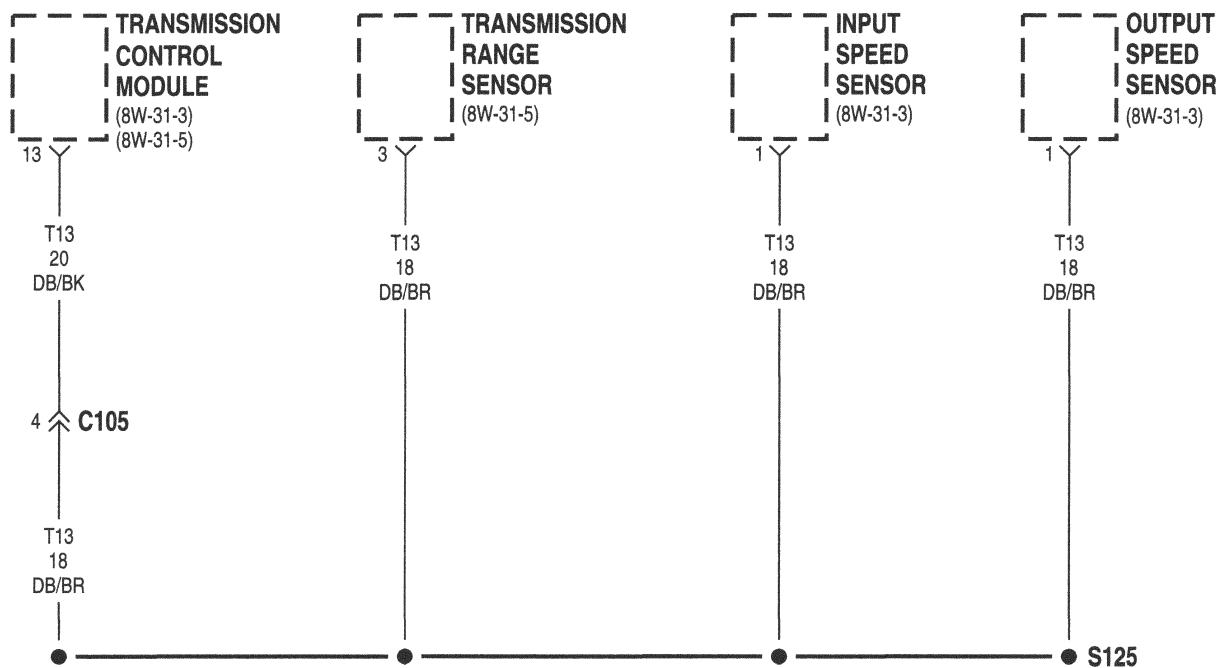


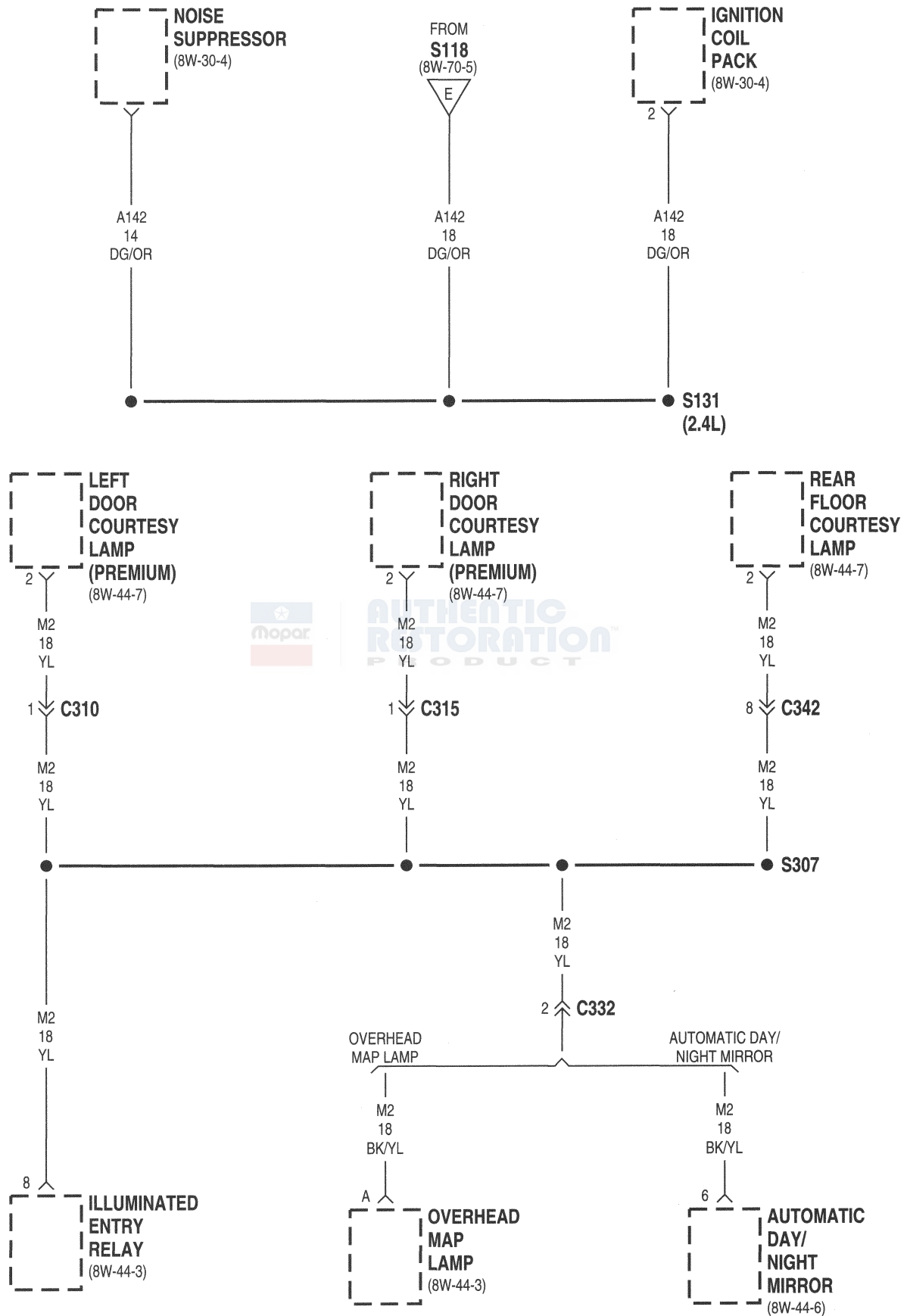






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## 8W-80 CONNECTOR PIN-OUTS

Component	Page	Component	Page
A/C Compressor Clutch . . . . .	8W-80-5	C300 . . . . .	8W-80-14
A/C Evaporator Temperature Sensor . . . . .	8W-80-5	C301 . . . . .	8W-80-14
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A/C Pressure Transducer . . . . .	8W-80-6	C309 . . . . .	8W-80-15
Airbag Control Module . . . . .	8W-80-6	C310 . . . . .	8W-80-15
Ash Receiver Lamp . . . . .	8W-80-7	C311 . . . . .	8W-80-16
Automatic Day/Night Mirror . . . . .	8W-80-7	C315 . . . . .	8W-80-16
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Battery Temperature Sensor . . . . .	8W-80-8	C332 . . . . .	8W-80-17
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C113 . . . . .	8W-80-11	Crankshaft Position Sensor . . . . .	8W-80-20
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C126 . . . . .	8W-80-12	Decklid Release Relay . . . . .	8W-80-21
C127 . . . . .	8W-80-12	Decklid Release Switch . . . . .	8W-80-21
C165 . . . . .	8W-80-13	Decklid Solenoid . . . . .	8W-80-21
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PRODUCT

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Fuel Injector No. 2 . . . . .	8W-80-24
Fuel Injector No. 3 . . . . .	8W-80-25
Fuel Injector No. 4 . . . . .	8W-80-25
Fuel Injector No. 5 . . . . .	8W-80-26
Fuel Injector No. 6 . . . . .	8W-80-26
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Generator . . . . .	8W-80-26
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Master Power Window Switch . . . . .	8W-80-39
Mode Door Actuator . . . . .	8W-80-39



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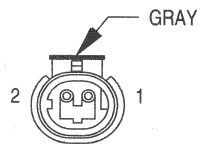
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Component	Page
Right Side Marker Lamp .....	8W-80-53
Right Tail/Lamp Stop Lamp .....	8W-80-53
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Component	Page
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Trunk Lamp .....	8W-80-57
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Washer Fluid Level Switch .....	8W-80-57
Window Timer Module .....	8W-80-58
Windshield Washer Pump .....	8W-80-58
Windshield Wiper Motor .....	8W-80-58

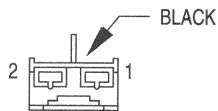


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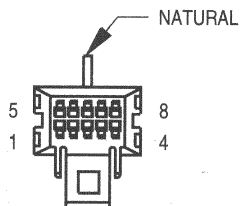
**A/C  
COMPRESSOR  
CLUTCH**

CAV	CIRCUIT	FUNCTION
1	C3 14DB/BK	A/C COMPRESSOR CLUTCH RELAY OUTPUT
2	-	-



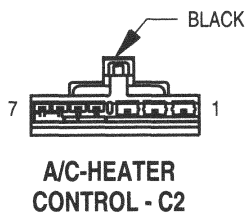
**A/C EVAPORATOR  
TEMPERATURE  
SENSOR**

CAV	CIRCUIT	FUNCTION
1	C57 22GY	SENSOR GROUND
2	C12 20LG/BK	EVAPORATOR TEMPERATURE SENSOR SIGNAL

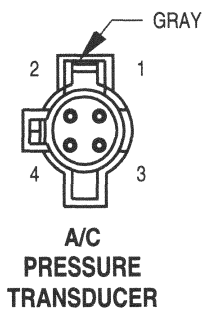


**A/C-HEATER  
CONTROL - C1**

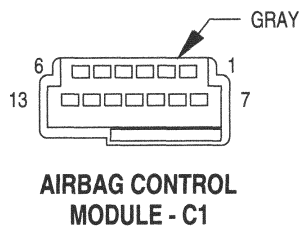
CAV	CIRCUIT	FUNCTION
1	-	-
2	C21 22DB/OR	A/C SWITCH SENSE
3	C16 22LB/YL	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
4	-	-
5	C58 22RD	MODE SWITCH SENSE
6	-	-
7	-	-
8	Z2 22BK/PK	GROUND



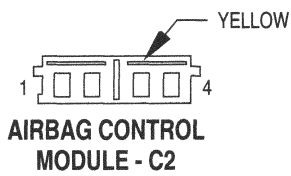
CAV	CIRCUIT	FUNCTION
1	Z1 12BK	GROUND
2	C7 12BK/TN	HIGH DRIVER BLOWER MOTOR
3	C6 18LB	M2 DRIVER BLOWER MOTOR
4	C5 18LG	M1 DRIVER BLOWER MOTOR
5	C4 18TN	LOW DRIVER BLOWER MOTOR
6	E2 18OR	PANEL LAMPS DRIVER
	E2 18OR	PANEL LAMPS DRIVER
7	-	-



CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	K6 20VT/WT	5V SUPPLY
3	C18 20DB	A/C PRESSURE SIGNAL
4	-	-

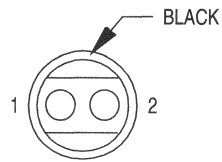


CAV	CIRCUIT	FUNCTION
1	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2	F23 18WT	FUSED IGNITION SWITCH OUTPUT (RUN)
3	D1 18VT/BR	CCD BUS (+)
4	D2 18WT/DB	CCD BUS (-)
5	-	-
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-
11	Z6 18BK/PK	GROUND
12	-	-
13	-	-



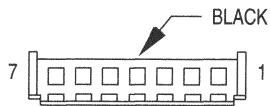
CAV	CIRCUIT	FUNCTION
1	R44 18DG/YL	PASSENGER AIRBAG LINE 1
2	R42 18BK/YL	PASSENGER AIRBAG LINE 2
3	R45 18DG/LB	DRIVER AIRBAG LINE 1
4	R43 18BK/LB	DRIVER AIRBAG LINE 2





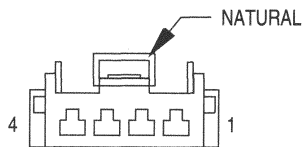
**ASH RECEIVER  
LAMP**

CAV	CIRCUIT	FUNCTION
1	E2 18OR	PANEL LAMPS DRIVER
2	Z1 18BK	GROUND



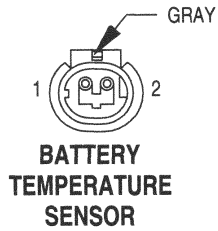
**AUTOMATIC  
DAY/NIGHT  
MIRROR**

CAV	CIRCUIT	FUNCTION
1	F20 20BK/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
2	Z1 18BK	GROUND
3	L1 18BK/VT	BACK-UP LAMP FEED
4	-	-
5	-	-
6	M2 18BK/YL	ILLUMINATED ENTRY RELAY OUTPUT
7	M1 18BK/PK	FUSED B(+)

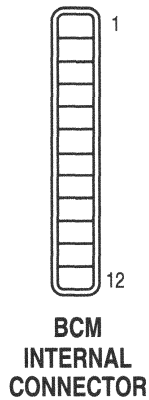


**AUTOSTICK  
SWITCH**

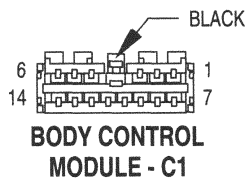
CAV	CIRCUIT	FUNCTION
1	T44 20YL/LB	AUTOSTICK DOWNSHIFT SWITCH SENSE
2	T5 20LG/LB	AUTOSTICK UPSHIFT SWITCH SENSE
3	Z13 20BK/RD	GROUND
4	F11 20RD/VT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)



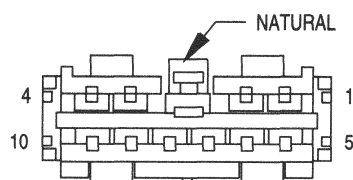
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K118 18PK/YL	BATTERY TEMPERATURE SENSOR SIGNAL



CAV	CIRCUIT	FUNCTION
1	L3	DIMMER SWITCH HIGH BEAM OUTPUT
2	F135	FUSED B(+)
3	C80	REAR WINDOW DEFOGGER RELAY CONTROL
4	L4	DIMMER SWITCH LOW BEAM OUTPUT
5	G50	HEADLAMP DELAY RELAY CONTROL
6	F11	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
7	X3	HORN RELAY CONTROL
8	L7	PARK LAMP SWITCH OUTPUT
9	M2	COURTESY LAMP DRIVER
10	Z1	GROUND
11	A21	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
12	M1	FUSED B(+)

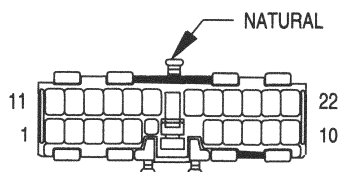


CAV	CIRCUIT	FUNCTION
1	G78 20TN/BK	DECKLID AJAR SWITCH SENSE
2	V55 20TN/RD	WIPER PARK SWITCH SENSE
3	Q33 18BR/LB	DECKLID RELEASE RELAY CONTROL
4	Z2 20BK/LG	GROUND
5	D1 20VT/BR	CCD BUS (+)
6	D1 20VT/DG	CCD BUS (+)
7	V14 20PK/VT	INTERMITTENT WIPER RELAY CONTROL
8	V16 20VT/PK	WIPER HIGH/LOW RELAY CONTROL
9	G43 20WT/RD	POWER TOP INHIBIT RELAY CONTROL
10	V10 18BR/DB	WASHER PUMP CONTROL SWITCH OUTPUT
11	-	-
12	Z2 20BK/LG	GROUND
13	D2 20WT/BK	CCD BUS (-)
14	D2 20WT/DG	CCD BUS (-)



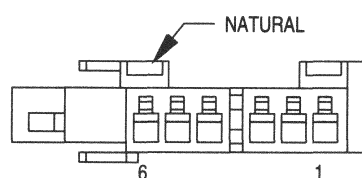
**BODY CONTROL  
MODULE - C2**

CAV	CIRCUIT	FUNCTION
1	G69 20BK/OR •	VTSS INDICATOR DRIVER
2	C35 22DG/YL	MODE DOOR DRIVER (+)
3	E2 18OR/YL	PANEL LAMPS DRIVER
4	E2 18OR/BR	PANEL LAMPS DRIVER
5	C26 20PK/DB	5V SUPPLY
6	C34 22DB/YL	MODE DOOR DRIVER (-)
7	-	-
8	Z2 20BK/LG	GROUND
9	E2 18OR	PANEL LAMPS DRIVER
10	E2 18OR/BK	PANEL LAMPS DRIVER



**BODY CONTROL  
MODULE - C3**

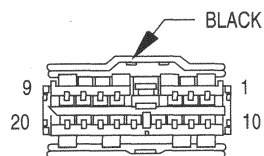
CAV	CIRCUIT	FUNCTION
1	D1 20VT/BR	CCD BUS (+)
2	D1 18VT/BR	CCD BUS (+)
3	-	-
4	Z2 20BK/VT	GROUND
5	C58 22RD	MODE SWITCH SENSE
6	C37 20YL	MODE DOOR FEEDBACK SIGNAL
7	C12 20LG/BK	EVAPORATOR TEMPERATURE SENSOR SIGNAL
8	-	-
9	-	-
10	V52 22DG/RD	WINDSHIELD WIPER SWITCH MUX
11	D2 20WT/DB	CCD BUS (-)
12	D2 18WT/DB	CCD BUS (-)
13	-	-
14	Z2 18BK/LG	GROUND
15	V10 18 BR/DB	WASHER PUMP CONTROL SWITCH OUTPUT
16	C21 22DB/OR	A/C SWITCH SENSE
17	G26 22LB	KEY-IN IGNITION SWITCH SENSE
18	E19 20RD	PANEL LAMPS DIMMER SIGNAL
19	Z2 22BK/PK	GROUND
20	C57 22GY/TN	SENSOR GROUND
21	C57 22GY	SENSOR GROUND
22	Z2 18BR/TN	GROUND



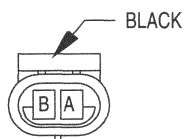
**BODY CONTROL  
MODULE - C4**

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	P158 20RD	RKE EXTERNAL ANTENNA
4	P58 20BK	RKE EXTERNAL ANTENNA
5	-	-
6	-	-

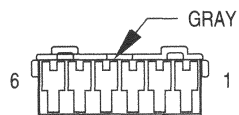
• VTSS



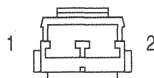
**BODY CONTROL  
MODULE - C5**



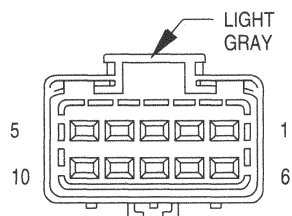
**BRAKE FLUID  
LEVEL SWITCH**



**BRAKE LAMP  
SWITCH**

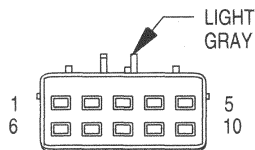


**BRAKE SHIFT  
INTERLOCK SOLENOID**



**C104**

CAV	CIRCUIT
1	T9 20OR/BK
2	T54 18VT/WT
3	T41 20BK/WT
4	-
5	T16 16RD/BR
6	T19 20WT
7	T41 20BK/LB
8	T50 18DG/TN
9	T59 18PK/DB
10	T60 18BR/TN



**C104**

CAV	CIRCUIT
1	T9 18OR/BK
2	T54 18VT/WT
3	T41 18BK/WT
4	-
5	T16 16RD/BR
6	T19 18WT/PK
7	T41 18BK/LB
8	T50 18DG/TN
9	T59 18PK/DB
10	T60 18BR/TN

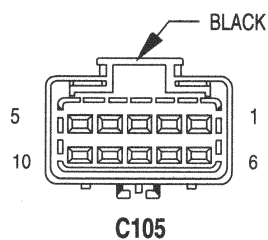
CAV	CIRCUIT	FUNCTION
1	P34 16PK/BK	DOOR UNLOCK DRIVER
2	-	-
3	-	-
4	P55 16DB/WT	LEFT FRONT DOOR UNLOCK DRIVER
5	G10 20LG/RD	SEAT BELT SWITCH SENSE
6	G74 18TN/RD	RIGHT DOOR AJAR SWITCH SENSE
7	G75 18TN	LEFT DOOR AJAR SWITCH SENSE
8	P97 20WT/DG	DRIVER DOOR SWITCH MUX
9	G71 20VT/YL ●●	TRUNK KEY CYLINDER SENSE
10	P33 16OR/BK	DOOR LOCK DRIVER
11	P33 16OR/WT	DOOR LOCK DRIVER
12	-	-
13	-	-
14	G38 18GY	BCM CONTROLLED ENABLE/DISABLE FEATURE
15	G4 18DB	FUEL LEVEL SENSOR SIGNAL
16	-	-
17	G74 20TN/PK	RIGHT DOOR AJAR SWITCH SENSE
18	P96 20WT/LG	PASSENGER DOOR SWITCH MUX
19	G73 18LG/OR ●●	LEFT DOOR KEY CYLINDER SWITCH SENSE
20	G72 18DG/OR ●●	RIGHT DOOR KEY CYLINDER SWITCH SENSE

CAV	CIRCUIT	FUNCTION
A	G9 20GY/DB	RED BRAKE WARNING INDICATOR DRIVER
B	Z1 20BK	GROUND

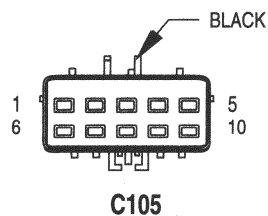
CAV	CIRCUIT	FUNCTION
1	K29 18WT/RD	BRAKE LAMP SWITCH SENSE
2	Z2 20BK/LG	GROUND
3	V32 20YL/PK	SPEED CONTROL POWER SUPPLY
4	V30 20DB/RD	SPEED CONTROL BRAKE SWITCH OUTPUT
5	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
6	A7 16RD/BK	FUSED B(+)

CAV	CIRCUIT	FUNCTION
1	K29 18WT/RD	BRAKE SWITCH SENSE
2	F18 18LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)

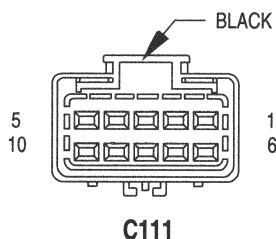




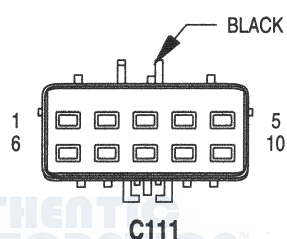
CAV	CIRCUIT
1	F20 18WT/YL
2	T1 20LG/BK
3	T3 18VT
4	T13 20DB/BK
5	T14 20LG/WT
6	T20 20LB
7	T42 18VT/TN
8	T47 20YL/BK
9	T52 20RD/BK
10	L1 18VT/BK



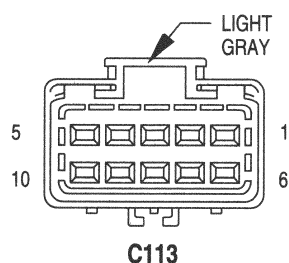
CAV	CIRCUIT
1	F20 18WT/YL
2	T1 18LG/GY
3	T3 18VT
4	T13 18DB/BR
5	T14 18LG/VT
6	T20 18LB/WT
7	T42 18VT/TN
8	T47 18YL/GY
9	T52 18OR/YL
10	L1 18VT/BK



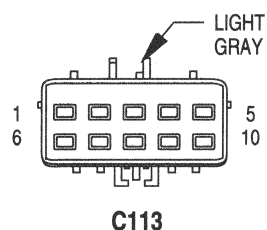
CAV	CIRCUIT
1	Z1 18BK
2	K39 20GY/RD
3	K40 20BR/WT
4	K59 20VT/BK
5	K7 18OR/WT
6	A142 18DG/OR
7	K60 20YL/BK
8	G6 20GY
9	K6 20VT/WT
10	K4 18BK/LB



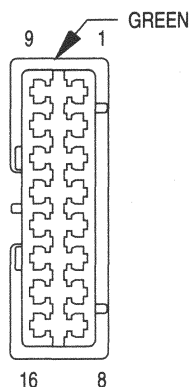
CAV	CIRCUIT
1	Z1 18BK
2	K39 20GY/RD
3	K40 20BR/WT
4	K59 20VT/BK
5	K7 20OR
6	A142 18DG/OR
7	K60 20YL/BK
8	G6 18GY
9	K6 20VT/WT
10	K4 18BK/LB



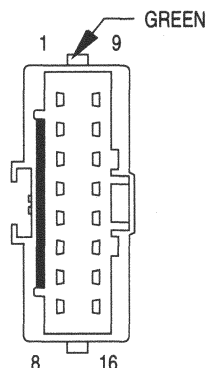
CAV	CIRCUIT
1	C3 14DB/BK
2	K90 18TN/RD
3	-
4	K24 18GY/BK
5	T40 14BR
6	F12 18DB/WT
7	C18 20DB/YL
8	V32 20YL/PK
9	K22 20OR/LB
10	Z12 18BK/TN



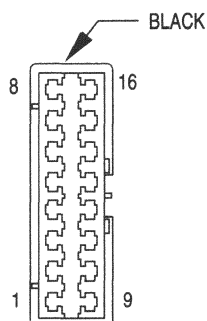
CAV	CIRCUIT
1	C3 14DB/BK
2	K90 20TN
3	-
4	K24 18GY/BK
5	T40 14BR
6	F12 18DB/WT
7	C18 20DB
8	V32 20YL/RD
9	K22 20OR/DB
10	Z12 18BK/TN

**C121**

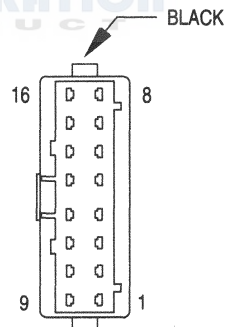
CAV	CIRCUIT
1	B1 18YL/DB
2	B2 18YL
3	B3 18LG/DB
4	B4 18LG
5	A141 14DG/WT
6	L1 18VT/BK
7	P118 20WT/BK
8	A45 18BR
9	A25 12DB
10	Q33 18BR/LB
11	F18 18LG/BK
12	K106 18WT/DG
13	-
14	G78 20TN/BK
15	K107 18OR
16	Z1 18BK
	Z2 20BK/LG

**C121**

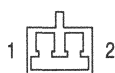
CAV	CIRCUIT
1	B1 20YL/DB
2	B2 20YL
3	B3 20LG/DB
4	B4 20LG
5	A141 14DG/WT
6	L1 18VT/BK
	L1 18VT/BK
7	P118 20WT/BK
8	A45 18BR
9	A25 12DB
10	Q33 18BR/LB
11	F18 18LG/BK
12	K106 18WT/DG
13	-
14	G78 20TN/BK
15	K107 18OR/DG
16	Z1 18BK

**C126**

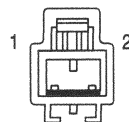
CAV	CIRCUIT
1	A2 12PK/BK
2	G6 20GY
3	V37 20RD/LG
4	D20 20LG
5	T5 20LG/LB
6	D21 20PK/LG
7	F18 18LG/BK
8	A41 16YL
9	A15 16PK
10	G29 20BK/TN
11	D6 20PK/LB
12	G87 18DG/LG
13	T44 20YL/LB
14	B27 18RD/YL
15	G19 18LG/OR
16	A1 16RD

**C126**

CAV	CIRCUIT
1	A2 12PK/BK
2	G6 20GY
3	V37 20RD/LG
4	D20 20LG
5	T5 20LG/LB ▲
6	D21 20PK/LG
7	F18 18LG/BK
	F18 20LG/BK ▲▲
8	A41 16YL
9	A15 18PK
10	G29 20BK/TN
11	D6 20PK/LB
12	G87 20DG/LG
13	T44 20YL/LB ▲
14	B27 20RD/YL
15	G19 20LG/OR
16	A1 16RD

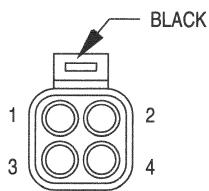
**C127**

CAV	CIRCUIT
1	A51 20RD/LB
2	K29 18WT/RD

**C127**

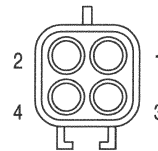
CAV	CIRCUIT
1	A51 20RD/LB
2	K29 18WT/RD
2	K29 18WT/RD

◇ ABS  
▲ AUTOSTICK  
▲▲ SKIM



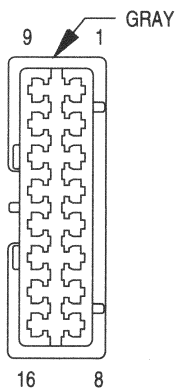
**C165  
(2.5L)**

CAV	CIRCUIT
1	A142 18DG/OR
2	K11 18WT/DB
3	K13 18YL/WT
4	K38 18GY



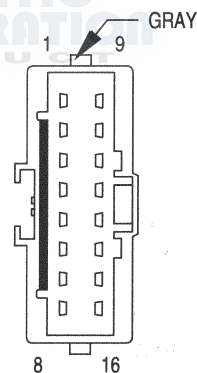
**C165  
(2.5L)**

CAV	CIRCUIT
1	A142 18DG/OR
2	K11 18WT/DB
3	K13 18YL/WT
4	K38 18GY



**C224**

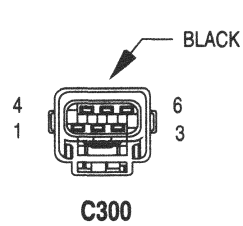
CAV	CIRCUIT
1	X52 18DB/WT
2	X80 18LB/DG
3	X82 18LB/VT
4	X58 18DB/OR
5	X51 18BR/YL
6	X85 18LG/DG
7	X87 18LG/VT
8	X57 18BR/LB
9	X60 20DG/RD ▲▲
10	-
11	P5 20YL/BK
12	P6 20RD/WT
13	F13 18DB
14	-
15	G9 18GY
16	E2 18OR/BK



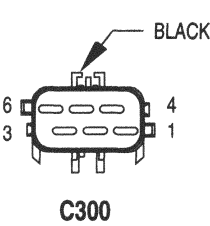
**C224**

CAV	CIRCUIT
1	X52 18DB/WT
2	X56 20DB/RD ▲
	X56 18DB/RD ▲
2	X80 18LB/DG ▲▲
3	X54 20VT ▲
	X54 18VT ▲
3	X82 18LB/VT ▲▲
4	X58 18DB/OR
5	X51 18BR/YL
6	X55 20BR/RD ▲
	X55 18BR/RD ▲
6	X85 18LG/DG ▲▲
7	X53 20DG ▲
	X53 18DG ▲
7	X87 18LG/VT ▲▲
8	X57 18BR/LB
9	X60 20DG/RD ▲▲
	X60 20DG/RD ▲▲
10	-
11	P5 20YL/BK ▲▲
12	P6 20RD/WT ▲▲
13	F13 18DB
	F13 18DB
14	-
15	G9 18GY
16	E2 18OR/BK
	E2 20OR/YL

▲ STANDARD RADIO  
▲▲ PREMIUM RADIO



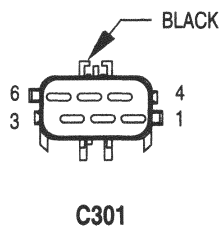
CAV	CIRCUIT
1	L1 18VT/BK
2	L50 18WT/TN
3	L61 18LG
4	L7 18BK/YL
5	Z1 18BK
6	-



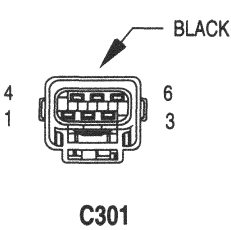
CAV	CIRCUIT
1	L1 18VT/BK
2	L50 18WT/TN
3	L61 18LG/TN
4	L7 18BK/YL
5	Z1 18BK
6	-



AUTHENTIC  
RESTORATION  
PRODUCT

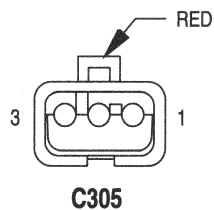


CAV	CIRCUIT
1	L1 18VT/BK
2	L50 18WT/TN
3	L60 18TN
4	L7 18BK/YL
5	Z1 18BK
6	-

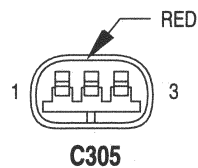


CAV	CIRCUIT
1	L1 18VT/BK
2	L50 18WT/TN
3	L60 18TN
4	L7 18BK/YL
5	Z1 18BK
6	-

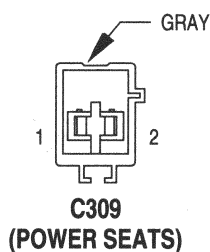




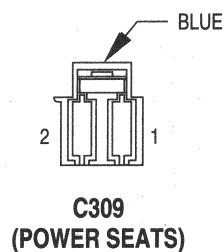
CAV	CIRCUIT
1	L50 18BK/TN
2	-
3	Z1 18BK



CAV	CIRCUIT
1	L50 18WT/TN
2	-
3	Z1 18BK



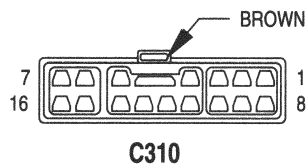
CAV	CIRCUIT
1	F35 16RD
2	Z1 16BK



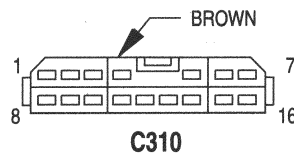
CAV	CIRCUIT
1	F35 16RD
2	Z1 16BK



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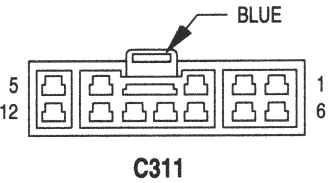


CAV	CIRCUIT
1	M2 18YL
2	M1 20PK
3	C16 20LB/OR
4	P90 20LG/BK
5	P91 20WT/BK
6	P92 20YL/LB
7	P94 20WT/YL
8	F20 20WT
9	P33 16OR/BK
10	P55 16DB/WT
11	P97 20WT/DG
12	G73 18LG/OR ▲
13	-
14	-
15	-
16	-

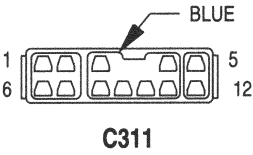


CAV	CIRCUIT
1	M2 18YL ▲
2	M1 18PK ●
2	M1 20PK ●●
3	C16 20LB/YL
4	P90 20LG/BK
5	P91 20WT/BK
6	P92 20YL/LB
7	P94 20WT/YL
8	F20 20WT
8	F20 20WT
9	P33 16OR/BK
10	P55 16DB/WT
11	P97 20WT/DG
12	G73 18LG/OR ▲
13	-
14	-
15	-
16	-

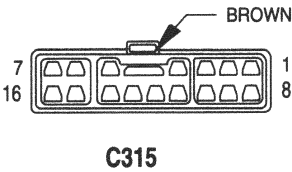
- VTSS
- ▲ PREMIUM
- WITHOUT VTSS



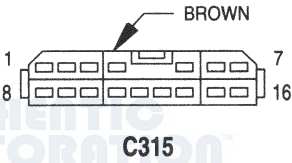
CAV	CIRCUIT
1	X85 18LG/DG
2	X87 18LG/VT
3	Q17 14DB/WT
4	Q18 14GY/BK
5	Q27 14RD/BK
6	Q28 14DG/WT
7	Q16 14BR/WT
8	Q26 14VT/WT
9	Z1 14BK
10	F21 14TN/VT
11	P5 20YL/BK
12	P6 20RD/WT



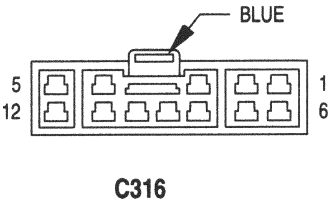
CAV	CIRCUIT
1	X85 18LG/DG
2	X87 18LG/VT
3	Q17 14DB/WT
4	Q18 14GY/BK
5	Q27 14RD/BK
6	Q28 14DG/WT
7	Q16 14BR/WT
8	Q26 14VT/WT
9	Z1 14BK
10	F21 14TN
11	P5 20YL/RD
12	P6 20RD/WT



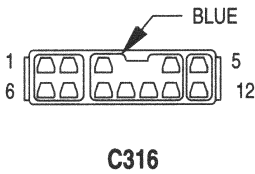
CAV	CIRCUIT
1	M2 18YL
2	M1 20PK
3	C16 20LB/YL
4	P90 20LG/BK
5	P91 20WT/BK
6	P92 20YL/LB
7	P94 20WT/YL
8	F20 20WT
9	P33 16OR/WT
10	P34 16PK/BK
11	P96 20WT/LG
12	G72 18DG/OR ▲
13	-
14	-
15	-
16	-



CAV	CIRCUIT
1	M2 18YL ▲
2	M1 18PK ●
2	M1 20PK ●●
3	C16 20LB/YL
4	P90 20LG/BK
5	P91 20WT/BK
6	P92 20YL/LB
7	P94 20WT/YL
8	F20 20WT
9	P33 16OR/BK
10	P34 16PK/BK
11	P96 20WT/LG
12	G72 18DG/OR ▲
13	-
14	-
15	-
16	-

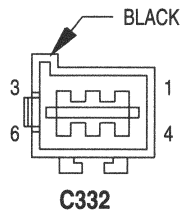


CAV	CIRCUIT
1	X80 18LB/DG
2	X82 18LB/VT
3	Q16 14BR/WT
4	Q26 14VT/WT
5	-
6	-
7	-
8	-
9	Z1 14BK ●
10	F21 14TN/WT
11	-
12	-

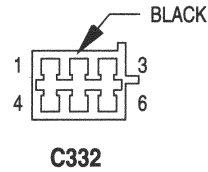


CAV	CIRCUIT
1	X80 18LB/DG
2	X82 18LB/VT
3	Q16 14BR/WT
4	Q26 14VT/WT
5	-
6	-
7	-
8	-
9	Z1 14BK ●
10	F21 14TN
11	-
12	-

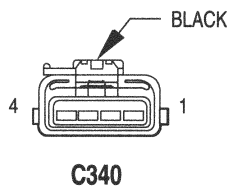
- VTSS
- WITHOUT VTSS
- ▲ PREMIUM



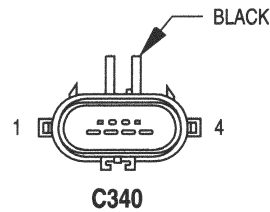
CAV	CIRCUIT
1	M1 20PK
2	M2 18YL
3	Z1 18BK
4	F20 20WT
5	G38 18GY
5	G38 18GY ●●
6	L1 18VT/BK



CAV	CIRCUIT
1	M1 18PK ▲
1	M1 18BK/PK ▲▲
2	M2 18BK/YL
3	Z1 18BK
4	F20 20BK/WT
5	G38 18GY
6	L1 18BK/VT



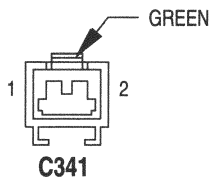
CAV	CIRCUIT
1	G10 20LG/RD
2	Z1 18BK
3	Z1 18BK
4	R7 18OR/BK



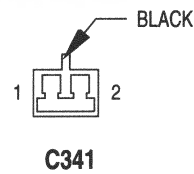
CAV	CIRCUIT
1	G10 20LG/RD
2	Z1 20BK/LG
3	Z1 18BK
4	R7 18OR/BK



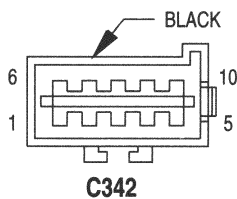
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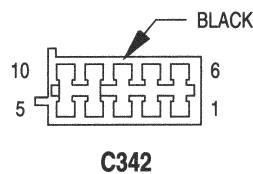
CAV	CIRCUIT
1	R8 18OR/RD
2	Z1 18BK



CAV	CIRCUIT
1	R8 18OR/RD
2	Z1 18BK

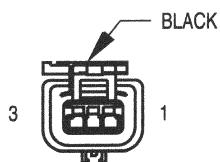


CAV	CIRCUIT
1	Q33 18BR/LB
2	P118 20WT
3	P5 20YL/BK
4	P6 20RD/WT
5	G38 18GY
6	Z1 18BK
6	Z1 18BK
7	M1 20PK
8	M2 18YL
9	E2 18OR/BK
9	E2 18OR/BK
10	-



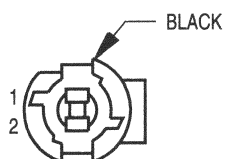
CAV	CIRCUIT
1	Q33 18BR/LB ●●
2	P118 20WT/BK
3	P5 20YL/BK
4	P6 20RD/WT
5	G38 18GY ●●
6	Z1 20BK
6	Z1 20BK
7	M1 18PK
8	M2 18YL
9	-
10	-

●● REMOTE DECKLID RELEASE  
▲ WITH VISOR/VANITY LAMP  
▲▲ WITHOUT VISOR/VANITY LAMPS



**CAMSHAFT  
POSITION  
SENSOR  
(2.4L)**

CAV	CIRCUIT	FUNCTION
1	K7 20OR	8V SUPPLY
2	K4 20BK/LB	SENSOR GROUND
3	K44 20TN/YL	CAMSHAFT POSITION SENSOR SIGNAL

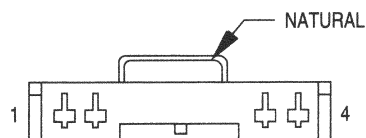


**CENTER HIGH  
MOUNTED STOP  
LAMP**

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L50 18BK/TN	BRAKE LAMP SWITCH OUTPUT

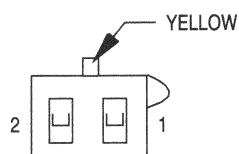


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**CLOCKSPRING NO. 1**

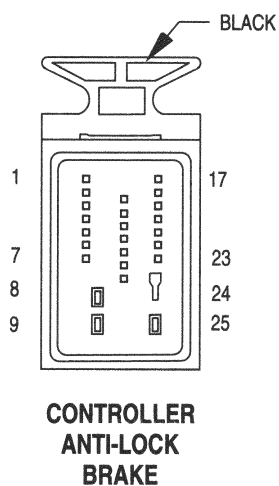
CAV	CIRCUIT	FUNCTION
1	X3 18BK/RD	HORN RELAY CONTROL
2	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
3	Z2 18BR/TN	GROUND
4	-	-



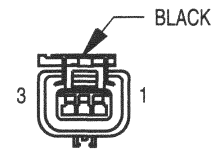
**CLOCKSPRING NO. 2**

CAV	CIRCUIT	FUNCTION
1	R43 18BK/LB	DRIVER AIRBAG LINE 2
2	R45 18DG/LB	DRIVER AIRBAG LINE 1



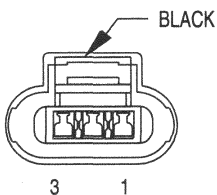


CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
3	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)
4	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)
5	-	-
6	G87 18DG/LG	TRACTION CONTROL WARNING INDICATOR DRIVER
7	-	-
8	Z1 12BK	GROUND
9	A20 12RD/DB	FUSED B(+)
10	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)
11	B8 18OR/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
12	L50 18WT/BR	BRAKE LAMP SWITCH OUTPUT
13	-	-
14	-	-
15	-	-
16	G19 18LG/OR	ABS WARNING INDICATOR DRIVER
17	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)
18	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
19	D2 18WT/DG	CCD BUS (-)
20	D1 18VT/DG	CCD BUS (+)
21	-	-
22	B27 18RD/YL	TRACTION CONTROL SWITCH SENSE
23	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
24	Z1 12BK	GROUND
25	A10 12RD/DG	FUSED B(+)



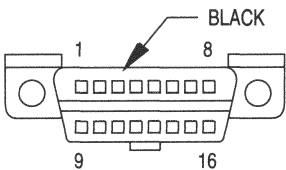
CRANKSHAFT  
POSITION  
SENSOR  
(2.4L)

CAV	CIRCUIT	FUNCTION
1	K7 20OR	8V SUPPLY
2	K4 20BK/LB	SENSOR GROUND
3	K24 20GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL



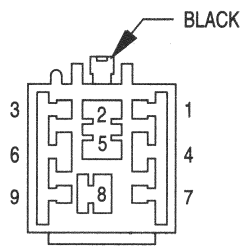
CRANKSHAFT  
POSITION  
SENSOR  
(2.5L)

CAV	CIRCUIT	FUNCTION
1	K7 20OR	8V SUPPLY
2	K4 20BK/LB	SENSOR GROUND
3	K24 20GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL



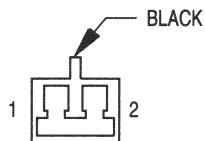
DATA LINK  
CONNECTOR

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	D1 20VT/BR	CCD BUS (+)
4	Z2 20BK/VT	GROUND
5	Z11 18BK	GROUND
6	D20 20LG	SCI RECEIVE
7	D21 20PK/LG	SCI TRANSMIT
8	-	-
9	-	-
10	-	-
11	D2 20WT/DB	CCD BUS (-)
12	-	-
13	-	-
14	D6 20PK/LB	SCI RECEIVE
15	-	-
16	M1 18PK/WT	FUSED B(+)



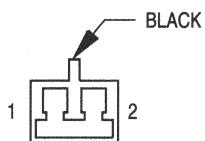
**DECKLID  
RELEASE  
RELAY**

CAV	CIRCUIT	FUNCTION
1	-	-
2	Q2 14LG/BK	DECKLID RELEASE RELAY OUTPUT
3	-	-
4	F35 16RD	FUSED B(+)
5	-	-
6	Q33 18BR/LB	DECKLID RELEASE RELAY CONTROL
	Q33 18BR/LB	DECKLID RELEASE RELAY CONTROL
7	-	-
8	F35 16RD	FUSED B(+)
9	-	-



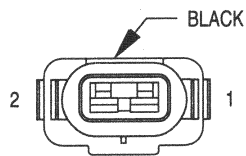
**DECKLID  
RELEASE  
SWITCH**

CAV	CIRCUIT	FUNCTION
1	Q33 18BR/LB	DECKLID RELEASE RELAY CONTROL
2	G38 18GY	BCM CONTROLLED ENABLE/DISABLE FEATURE



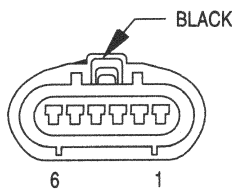
**DECKLID  
SOLENOID**

CAV	CIRCUIT	FUNCTION
1	Q2 14LG/BK	DECKLID RELEASE RELAY OUTPUT
2	Z1 14BK	GROUND



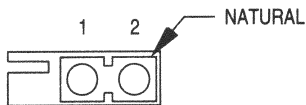
DISTRIBUTOR - C1  
(2.5L)

CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	-	-



DISTRIBUTOR - C2  
(2.5L)

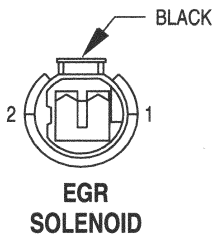
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K7 20OR	8V SUPPLY
3	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
4	-	-
5	Z1 16BK	GROUND
6	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER



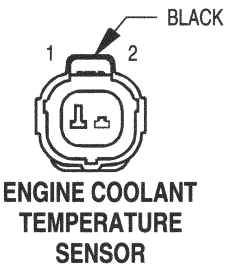
DRIVER SEAT  
BELT SOLENOID

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	R7 18OR/BK	LEFT SEAT BELT SOLENOID CONTROL

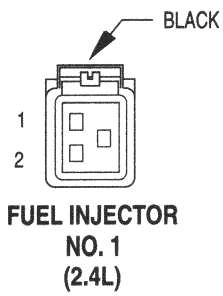




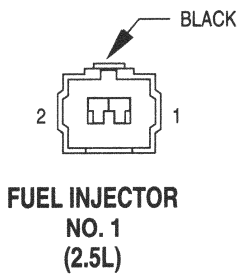
CAV	CIRCUIT	FUNCTION
1	K35 18GY/YL	EGR SOLENOID CONTROL
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



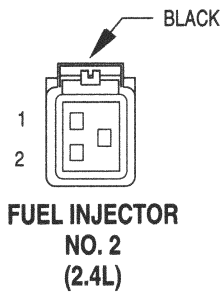
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



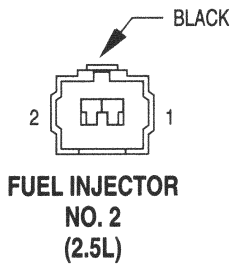
CAV	CIRCUIT	FUNCTION
1	K11 18WT/DB	INJECTOR NO.1 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



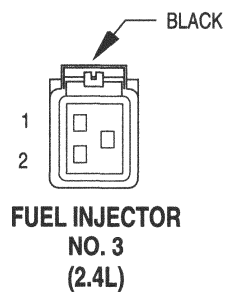
CAV	CIRCUIT	FUNCTION
1	K11 18WT/DB	INJECTOR NO. 1 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



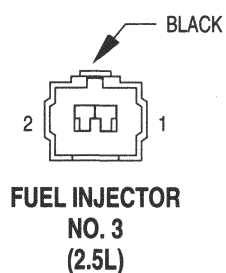
CAV	CIRCUIT	FUNCTION
1	K12 18TN	INJECTOR NO. 2 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



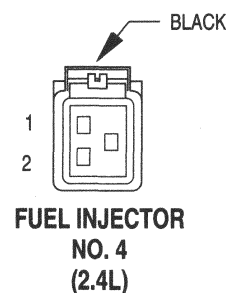
CAV	CIRCUIT	FUNCTION
1	K12 18TN	INJECTOR NO. 2 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



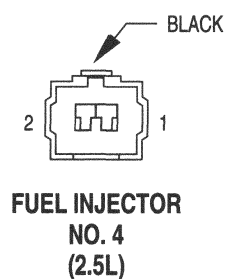
CAV	CIRCUIT	FUNCTION
1	K13 18YL/WT	INJECTOR NO. 3 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



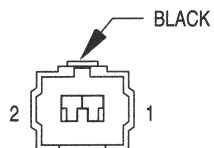
CAV	CIRCUIT	FUNCTION
1	K13 18YL/WT	INJECTOR NO. 3 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



CAV	CIRCUIT	FUNCTION
1	K14 18LB/BR	INJECTOR NO. 4 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT

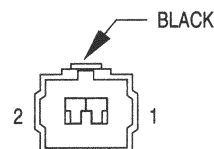


CAV	CIRCUIT	FUNCTION
1	K14 18LB/BR	INJECTOR NO. 4 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT



**FUEL INJECTOR  
NO. 5  
(2.5L)**

CAV	CIRCUIT	FUNCTION
1	K38 18GY	INJECTOR NO. 5 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT

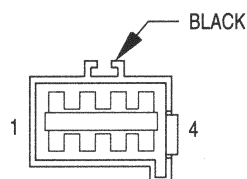


**FUEL INJECTOR  
NO. 6  
(2.5L)**

CAV	CIRCUIT	FUNCTION
1	K58 18BR/DB	INJECTOR NO. 6 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT

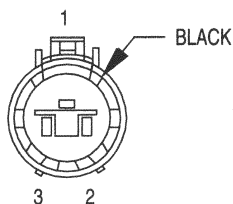


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**FUEL PUMP  
MODULE**

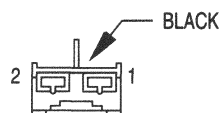
CAV	CIRCUIT	FUNCTION
1	A141 14DG/WT	FUEL PUMP RELAY OUTPUT
2	G4 18DB	FUEL LEVEL SENSOR SIGNAL
3	Z1 16BK	GROUND
4	Z2 18BK/LG	GROUND
5	F18 18LG/BK	FUSED IGNITION SWITCH OUTPUT
6	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
7	K107 18OR/DG	LEAK DETECTION PUMP SWITCH SENSE



**GENERATOR**

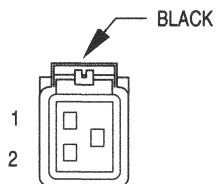
CAV	CIRCUIT	FUNCTION
1	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K20 18DG	GENERATOR FIELD DRIVER
3	-	-





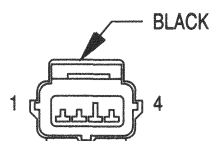
**GLOVE BOX  
LAMP**

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	M1 20PK/WT	FUSED B(+)



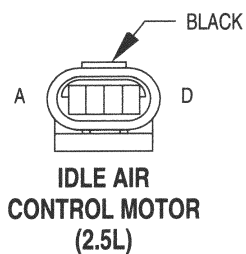
**HIGH NOTE  
HORN**

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	X2 18DG/PK	HORN RELAY OUTPUT

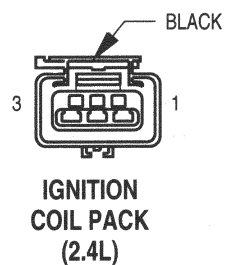


**IDLE AIR  
CONTROL MOTOR  
(2.4L)**

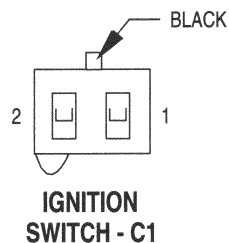
CAV	CIRCUIT	FUNCTION
1	K39 20GY/RD	IDLE AIR CONTROL MOTOR NO. 1 DRIVER
2	K60 20YL/BK	IDLE AIR CONTROL MOTOR NO. 2 DRIVER
3	K40 20BR/WT	IDLE AIR CONTROL MOTOR NO. 3 DRIVER
4	K59 20VT/BK	IDLE AIR CONTROL MOTOR NO. 4 DRIVER



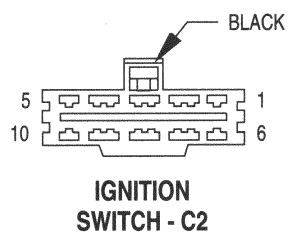
CAV	CIRCUIT	FUNCTION
A	K59 20VT/BK	IDLE AIR CONTROL MOTOR NO. 4 DRIVER
B	K40 20BR/WT	IDLE AIR CONTROL MOTOR NO. 3 DRIVER
C	K60 20YL/BK	IDLE AIR CONTROL MOTOR NO. 2 DRIVER
D	K39 20GY/RD	IDLE AIR CONTROL MOTOR NO. 1 DRIVER



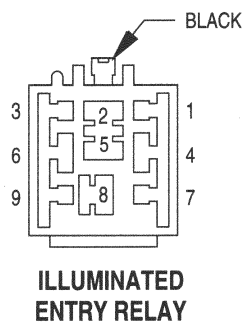
CAV	CIRCUIT	FUNCTION
1	K17 18DB/TN	IGNITION COIL NO. 2 DRIVER
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K19 18BK/GY	IGNITION COIL NO. 1 DRIVER



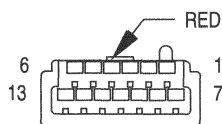
CAV	CIRCUIT	FUNCTION
1	A51 20RD/LB	FUSED B(+)
2	A81 18DG/RD	IGNITION SWITCH OUTPUT (ST-RUN-OFF)



CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G9 22GY/DB	RED BRAKE WARNING INDICATOR DRIVER
3	A2 12PK/BK	FUSED B(+)
4	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
5	-	-
6	-	-
7	A1 16RD	FUSED B(+)
8	A31 16BK/WT	IGNITION SWITCH OUTPUT (RUN-ACC)
9	A21 16DB	IGNITION SWITCH OUTPUT (ST-RUN)
10	A41 16YL	IGNITION SWITCH OUTPUT (ST)

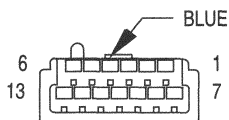


CAV	CIRCUIT	FUNCTION
1	-	-
2	Z1 18BK	GROUND
3	-	-
4	M1 20PK	FUSED B(+)
	M1 20PK	FUSED B(+)
5	-	-
6	M112 20BR/LG	ILLUMINATED ENTRY RELAY CONTROL
7	-	-
8	M2 18YL	ILLUMINATED ENTRY RELAY OUTPUT
9	-	-



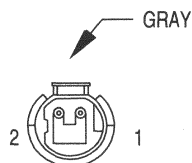
**INSTRUMENT  
CLUSTER - C1**

CAV	CIRCUIT	FUNCTION
1	L60 18TN/BR	RIGHT TURN SIGNAL
2	F11 18RD/VT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
	F11 20RD/VT ▲	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
3	-	-
4	Z2 18BK/LG	GROUND
5	F33 20PK/RD	FUSED B(+)
6	-	-
7	G69 20BK/OR ▲▲	VTSS INDICATOR DRIVER
8	G29 20BK/TN	WASHER FLUID SWITCH SENSE
9	-	-
10	-	-
11	-	-
12	-	-
13	-	-



**INSTRUMENT  
CLUSTER - C2**

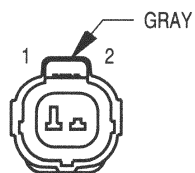
CAV	CIRCUIT	FUNCTION
1	L39 18LB	FOG LAMP SWITCH OUTPUT
2	L61 18LG/TN	LEFT TURN SIGNAL
3	D2 20WT/BK ■	CCD BUS (-)
4	D1 20VT ■	CCD BUS (+)
5	F18 18LG/BK ■■	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
	F18 18LG/BK ■■	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
5	F18 20LG/BK ■	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
6	G9 22GY/DB	RED BRAKE WARNING INDICATOR DRIVER
7	D2 20WT/DB	CCD BUS (-)
8	D1 20VT/BR	CCD BUS (+)
9	G87 20DG/LG	TRACTION CONTROL WARNING INDICATOR DRIVER
10	E2 18OR/YL	PANEL LAMPS DRIVER
11	Z1 18BK/OR	GROUND
12	G6 20GY	ENGINE OIL PRESSURE SWITCH SENSE
13	G19 20LG/OR	ABS WARNING INDICATOR DRIVER



**INPUT SPEED  
SENSOR**

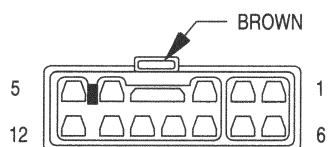
CAV	CIRCUIT	FUNCTION
1	T13 18DB/BR	SPEED SENSOR GROUND
2	T52 18OR/YL	INPUT SPEED SENSOR SIGNAL

- ▲ AUTOSTICK
- ▲▲ VTSS
- TRAVELER
- EXCEPT TRAVELER



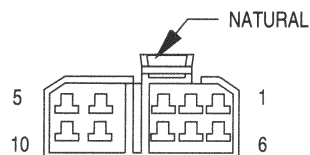
**INTAKE AIR  
TEMPERATURE SENSOR**

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K21 18BK/RD	INTAKE AIR TEMPERATURE SIGNAL



**JUNCTION  
BLOCK - C1**

CAV	CIRCUIT	FUNCTION
1	G9 20GY/DB	RED BRAKE WARNING INDICATOR DRIVER
2	-	-
3	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
4	L60 18TN/BR	RIGHT TURN SIGNAL
5	L61 18LG/TN	LEFT TURN SIGNAL
6	L33 18LG/BR	FUSED LEFT HIGH BEAM OUTPUT
7	-	-
8	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
9	L7 18BK/BR	HEADLAMP SWITCH OUTPUT
10	L39 18LB •	FOG LAMP SWITCH OUTPUT
11	L39 18 LB •	FOG LAMP SWITCH OUTPUT
12	L43 18VT/OR	FUSED LEFT LOW BEAM OUTPUT

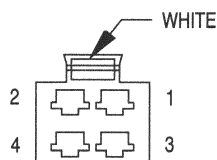


**JUNCTION  
BLOCK - C2**

CAV	CIRCUIT	FUNCTION
1	L50 18WT/BR	BRAKE LAMP SWITCH OUTPUT
2	A7 16RD/BK	FUSED B(+)
3	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
4	F20 18WT/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
5	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
6	F11 18RD/VT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
7	A21 16DB	IGNITION SWITCH OUTPUT (ST-RUN)
8	X2 18DG/PK	HORN RELAY OUTPUT
	X2 18DG/PK	HORN RELAY OUTPUT
9	-	-
10	F13 20DB/GY	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)

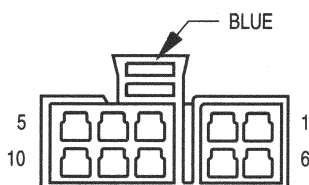
• FOG LAMPS





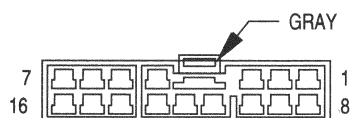
**JUNCTION  
BLOCK - C3**

CAV	CIRCUIT	FUNCTION
1	A7 12RD/BK	FUSED B(+)
2	A13 12PK/WT	FUSED B(+)
3	A3 12RD/WT	FUSED B(+)
4	A4 12BK/PK	FUSED B(+)



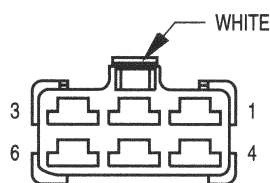
**JUNCTION  
BLOCK - C4**

CAV	CIRCUIT	FUNCTION
1	-	-
2	Z1 18BK/OR	GROUND
3	Z1 18BK/TN	GROUND
4	F23 18WT	FUSED IGNITION SWITCH OUTPUT (RUN)
5	G9 22GY/DB	RED BRAKE WARNING INDICATOR DRIVER
6	Z1 20BK	GROUND
7	Z1 20BK/WT	GROUND
8	Z13 20BK/RD	GROUND
9	Z1 16BK/LB	GROUND
10	Z1 20BK	GROUND



**JUNCTION  
BLOCK - C5**

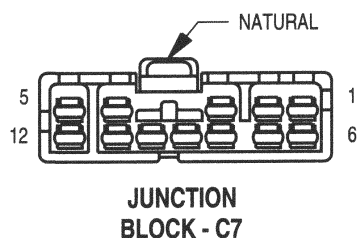
CAV	CIRCUIT	FUNCTION
1	F30 18RD	FUSED B(+)
2	-	-
3	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
4	L7 18BK/DG	HEADLAMP SWITCH OUTPUT
5	L39 18LB	• FOG LAMP SWITCH OUTPUT
6	G9 18GY	RED BRAKE WARNING INDICATOR DRIVER
7	G9 22GY/DB	RED BRAKE WARNING INDICATOR DRIVER
8	X3 18BK/RD	HORN RELAY CONTROL
9	A21 16DB	IGNITION SWITCH OUTPUT (ST-RUN)
10	L39 18LB	• FOG LAMP SWITCH OUTPUT
11	M1 18PK/WT	FUSED B(+)
12	M1 20PK	FUSED B(+)
13	M1 16PK/DB	•• FUSED B(+)
14	A31 16BK/WT	IGNITION SWITCH OUTPUT (RUN-ACC)
15	Z11 18BK	GROUND
16	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (ST-RUN)



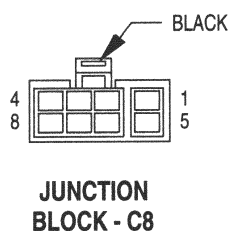
**JUNCTION  
BLOCK - C6**

CAV	CIRCUIT	FUNCTION
1	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
2	L4 14VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
3	L3 14RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
4	A3 14RD/WT	FUSED B(+)
5	-	-
6	C1 12DG	BLOWER MOTOR FEED

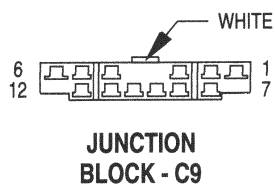
• FOG LAMPS  
•• PREMIUM RADIO



CAV	CIRCUIT	FUNCTION
1	F13 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	A81 18DG/RD	IGNITION SWITCH OUTPUT (ST-RUN-OFF)
3	L60 18TN/BR	RIGHT TURN SIGNAL
4	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
5	C16 22LB/YL	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
6	X12 18RD/WT	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
7	L61 18LG	LEFT TURN SIGNAL
8	L60 18TN	RIGHT TURN SIGNAL
9	L61 18LG/TN	LEFT TURN SIGNAL
10	F11 18RD/VT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
11	F33 20PK/RD	FUSED B(+)
12	F33 18BK/RD	FUSED B(+)

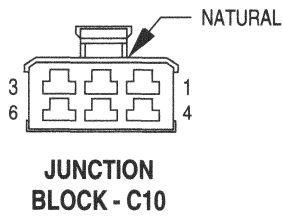


CAV	CIRCUIT	FUNCTION
1	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
2	M1 20PK ◇	FUSED B(+)
3	C16 20LB/YL ◇◇	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
4	C16 20LB/OR ◇◇	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
5	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
6	F21 14TN/VT	FUSED IGNITION SWITCH OUTPUT (RUN)
7	F21 14TN/WT	FUSED IGNITION SWITCH OUTPUT (RUN)
8	-	-

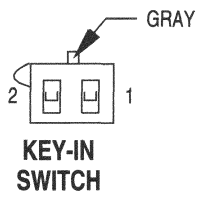


CAV	CIRCUIT	FUNCTION
1	F35 16RD	FUSED B(+)
2	F20 20WT	FUSED IGNITION SWITCH OUTPUT (RUN)
3	Z1 14BK	GROUND
4	L60 18TN	RIGHT TURN SIGNAL
5	L61 18LG/TN	LEFT TURN SIGNAL
6	C15 12BK/LB	REAR WINDOW DEFOGGER RELAY OUTPUT
7	M1 20PK ◇	FUSED B(+)
8	-	-
9	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
10	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
11	M1 20PK/OR ●	FUSED B(+)
12	M1 20PK/VT	FUSED B(+)

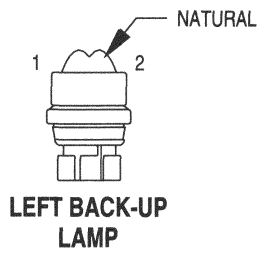
- ◇ POWER LOCKS
- ◇◇ HEATED MIRRORS
- PREMIUM RADIO



CAV	CIRCUIT	FUNCTION
1	M112 20BR/LG	ILLUMINATED ENTRY RELAY CONTROL
2	-	-
3	-	-
4	Z1 18BK	GROUND
	Z1 18BK	GROUND
5	-	-
6	M1 20PK	FUSED B(+)
	M1 20PK	FUSED B(+)



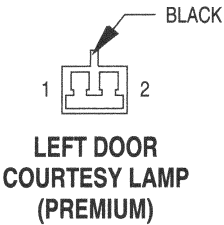
CAV	CIRCUIT	FUNCTION
1	G26 22LB	KEY-IN IGNITION SWITCH SENSE
2	Z1 20BK/WT	GROUND



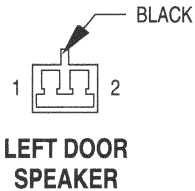
CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	Z1 18BK	GROUND



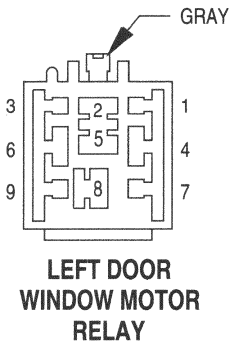
CAV	CIRCUIT	FUNCTION
1	G73 18 LG/OR	LEFT DOOR KEY CYLINDER SWITCH SENSE
2	M1 18PK	FUSED B(+)



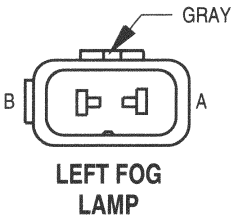
CAV	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	M2 18YL	ILLUMINATED ENTRY RELAY OUTPUT



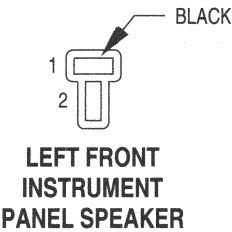
CAV	CIRCUIT	FUNCTION
1	X85 18LG/DG	LEFT DOOR SPEAKER (-)
2	X87 18LG/VT	LEFT DOOR SPEAKER (+)



CAV	CIRCUIT	FUNCTION
1	-	-
2	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
3	-	-
4	G10 20LG/RD	WINDOW MOTOR RELAY CONTROL
5	Q29 14DG	MASTER WINDOW SWITCH LEFT FRONT DOWN
6	Z1 20BK	GROUND
7	-	-
8	Q21 14WT	MASTER WINDOW SWITCH LEFT FRONT DOWN
9	-	-



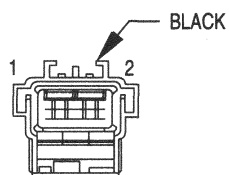
CAV	CIRCUIT	FUNCTION
A	L39 18LB	FOG LAMP SWITCH OUTPUT
B	Z1 18BK	GROUND



CAV	CIRCUIT	FUNCTION
1	X53 18DG •	LEFT FRONT SPEAKER (+)
	X81 18YL/BK ••	AMPLIFIED LEFT INSTRUMENT PANEL SPEAKER (-)
2	X55 18BR/RD •	LEFT FRONT SPEAKER (-)
	X83 18YL/RD ••	AMPLIFIED LEFT INSTRUMENT PANEL SPEAKER (+)

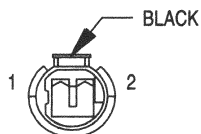
- STANDARD RADIO
- PREMIUM RADIO





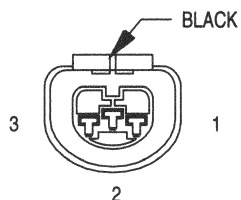
**LEFT FRONT  
POWER WINDOW  
MOTOR**

CAV	CIRCUIT	FUNCTION
1	Q21 14WT	MASTER WINDOW SWITCH LEFT FRONT DOWN
2	Q11 14LB	LEFT WINDOW DRIVER (UP)



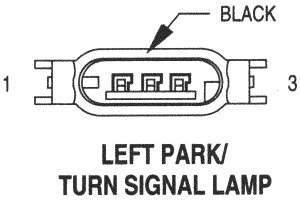
**LEFT FRONT  
WHEEL SPEED  
SENSOR**

CAV	CIRCUIT	FUNCTION
1	B8 18OR/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
2	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)



**LEFT HEADLAMP**

CAV	CIRCUIT	FUNCTION
1	L43 18VT/OR	FUSED LEFT LOW BEAM OUTPUT
2	Z1 18BK	GROUND
3	L33 18LG/BR	FUSED LEFT HIGH BEAM OUTPUT



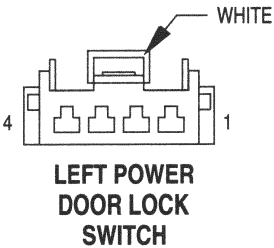
CAV	CIRCUIT	FUNCTION
1	L61 18LG/TN	LEFT TURN SIGNAL
2	L7 18BK/BR	HEADLAMP SWITCH OUTPUT
3	Z1 18BK	GROUND



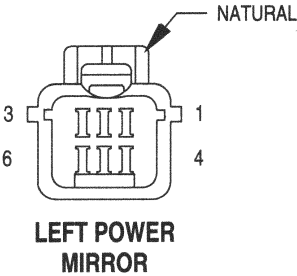
CAV	CIRCUIT	FUNCTION
1	P55 16DB/WT	LEFT FRONT DOOR UNLOCK DRIVER
2	P33 16OR/BK	LEFT FRONT DOOR LOCK DRIVER



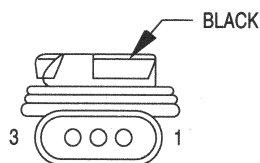
**AUTHENTIC  
RESTORATION  
PRODUCT**



CAV	CIRCUIT	FUNCTION
1	M1 20 PK	FUSED B(+)
2	F20 20WT	FUSED IGNITION SWITCH OUTPUT (RUN)
3	Z1 20BK	GROUND
4	P97 20WT/DG	DRIVER DOOR SWITCH MUX

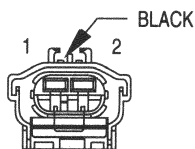


CAV	CIRCUIT	FUNCTION
1	P95 20DB/WT	LEFT POWER MIRROR HORIZONTAL DRIVER
2	Z1 20BK	GROUND
3	C16 20LB/YL	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
4	P91 20WT/BK	POWER MIRROR COMMON HORIZONTAL
5	P90 20LG/BK	POWER MIRROR COMMON VERTICAL
6	P93 20YL/BK	LEFT POWER MIRROR VERTICAL DRIVER



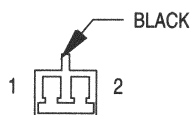
**LEFT REAR  
PARK/TURN  
SIGNAL LAMP**

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
3	L61 18LG	LEFT TURN SIGNAL



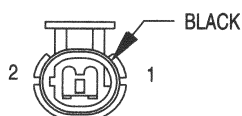
**LEFT REAR  
POWER WINDOW  
MOTOR**

CAV	CIRCUIT	FUNCTION
1	Q27 14RD/BK	LEFT RIGHT WINDOW DRIVER (DOWN)
2	Q17 14DB/WT	LEFT REAR WINDOW DRIVER (UP)



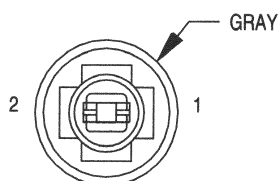
**LEFT REAR  
SPEAKER**

CAV	CIRCUIT	FUNCTION
1	X57 18BR/LB	LEFT REAR SPEAKER (-)
2	X51 18BR/YL	LEFT REAR SPEAKER (+)



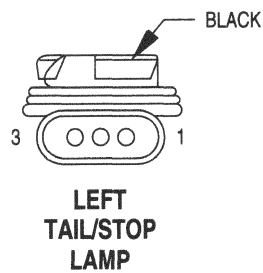
**LEFT REAR  
WHEEL SPEED  
SENSOR**

CAV	CIRCUIT	FUNCTION
1	B3 20LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
2	B4 20LG	LEFT REAR WHEEL SPEED SENSOR (+)

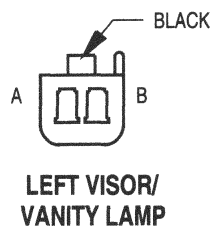


**LEFT SIDE  
MARKER LAMP**

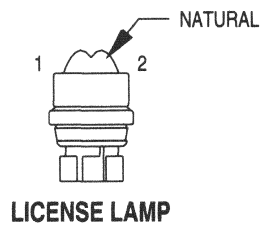
CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	Z1 18BK	GROUND



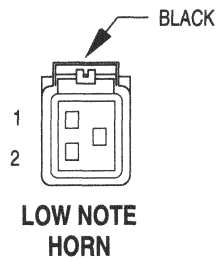
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
3	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT



CAV	CIRCUIT	FUNCTION
A	M1 18PK	FUSED B(+)
B	G38 18GY	BCM CONTROLLED ENABLE/DISABLE FEATURE



CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	Z1 18BK	GROUND

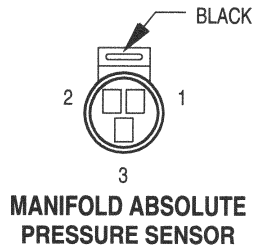


CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	X2 18DG/PK	HORN RELAY OUTPUT

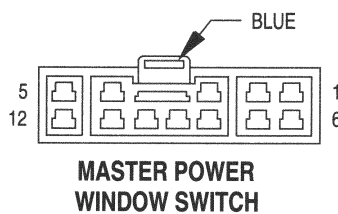


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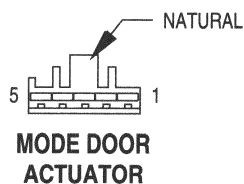




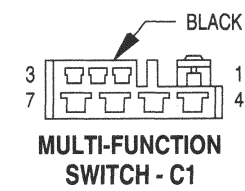
CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K6 18VT/WT	5V SUPPLY
3	K1 18DG/RD	MANIFOLD ABSOLUTE PRESSURE SENSOR SIGNAL



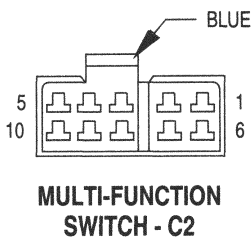
CAV	CIRCUIT	FUNCTION
1	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
2	Q17 14DB/WT	LEFT REAR WINDOW DRIVER (UP)
3	Q31 14OR	LEFT REAR WINDOW DRIVER (DOWN)
4	Q18 14GY/BK	RIGHT REAR WINDOW DRIVER (UP)
5	-	-
6	-	-
7	Q11 14LB	LEFT WINDOW DRIVER (UP)
8	Q29 14DG	MASTER WINDOW SWITCH LEFT FRONT DOWN (SWITCH)
9	Q32 14BR	RIGHT REAR WINDOW DRIVER (DOWN) (SWITCH)
10	Z1 20BK	GROUND
11	Q30 14VT	MASTER WINDOW SWITCH RIGHT FRONT DOWN
12	Q16 14BR/WT	MASTER WINDOW SWITCH RIGHT FRONT UP



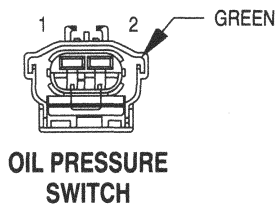
CAV	CIRCUIT	FUNCTION
1	C35 22DG/YL	MODE DOOR DRIVER (+)
2	C57 22GY/TN	SENSOR GROUND
3	C37 20YL	MODE DOOR FEEDBACK SIGNAL
4	C26 20PK/DB	5V SUPPLY
5	C34 22DB/YL	MODE DOOR DRIVER (-)



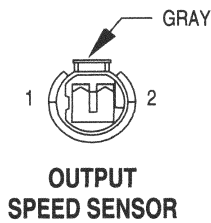
CAV	CIRCUIT	FUNCTION
1	V10 18BR/DB	WASHER PUMP CONTROL SWITCH OUTPUT
2	V52 22DG/RD	WINDSHIELD WIPER SWITCH MUX
3	F13 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
4	A15 18PK	FUSED B(+)
	A15 20PK	FUSED B(+)
5	Z1 18BK/TN	GROUND
	Z1 20BK	GROUND
6	L60 18TN	RIGHT TURN SIGNAL
7	L61 18LG	LEFT TURN SIGNAL



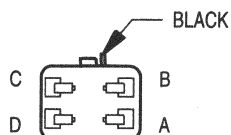
CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	F33 18BK/RD	FUSED B(+)
3	-	-
4	A3 14RD/WT	FUSED B(+)
5	-	-
6	E19 20RD	PANEL LAMPS DIMMER SIGNAL
7	L4 14VT/WT	DIMMER SWITCH LOW BEAM OUTPUT
8	L3 14RD/OR	DIMMER SWITCH HIGH BEAM OUTPUT
9	L39 18LB	FOG LAMP SWITCH OUTPUT
10	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT



CAV	CIRCUIT	FUNCTION
1	G6 18GY	ENGINE OIL PRESSURE SENSE
2	-	-

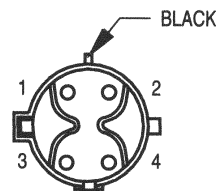


CAV	CIRCUIT	FUNCTION
1	T13 18DB/BR	SPEED SENSOR GROUND
2	T14 18LG/VT	OUTPUT SPEED SENSOR SIGNAL



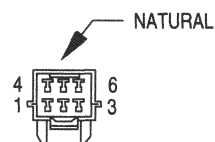
**OVERHEAD  
MAP LAMP**

CAV	CIRCUIT	FUNCTION
A	M2 18BK/YL	ILLUMINATED ENTRY RELAY OUTPUT
B	Z1 18BK	GROUND
C	M1 18BK/PK	FUSED B(+)
D	-	-



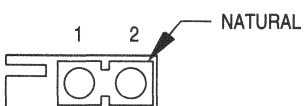
**OXYGEN SENSOR  
1/1 UPSTREAM**

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K127 18BK/OR	OXYGEN SENSOR GROUND
4	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL



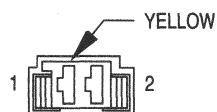
**OXYGEN SENSOR  
1/2 DOWNSTREAM**

CAV	CIRCUIT	FUNCTION
1	K141 20TN/WT	OXYGEN SENSOR 1/2 SIGNAL
2	-	-
3	K4 20BK/LB	SENSOR GROUND
4	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
5	-	-
6	Z1 20BK	GROUND



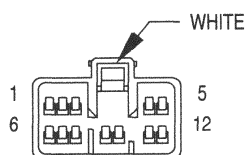
**PASSENGER  
SEAT BELT  
SOLENOID**

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	R8 18OR/RD	RIGHT SEAT BELT SOLENOID CONTROL



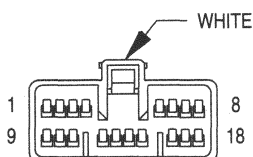
**PASSENGER  
SIDE AIRBAG**

CAV	CIRCUIT	FUNCTION
1	R44 18DG/YL	PASSENGER AIRBAG LINE 1
2	R42 18BK/YL	PASSENGER AIRBAG LINE 2



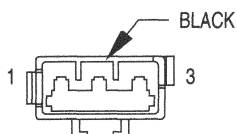
**POWER  
AMPLIFIER - C1  
(PREMIUM)**

CAV	CIRCUIT	FUNCTION
1	X91 20WT/BK	LEFT REAR SPEAKER (-)
2	X92 20TN/BK	RIGHT REAR SPEAKER (-)
3	X55 20BR/RD	LEFT FRONT SPEAKER (-)
4	X60 20DG/RD	RADIO 12V OUTPUT
5	P5 20YL/BK	CONVERTIBLE TOP DOWN RELAY B(+)
6	X93 20WT/RD	LEFT REAR SPEAKER (+)
7	X94 20TN/RD	RIGHT REAR SPEAKER (+)
8	X53 20DG	LEFT FRONT SPEAKER (+)
9	X56 20DB/RD	RIGHT FRONT SPEAKER (-)
10	X54 20VT	RIGHT FRONT SPEAKER (+)
11	P6 20RD/WT	CONVERTIBLE TOP UP RELAY B(+)
12	-	-



**POWER  
AMPLIFIER - C2  
(PREMIUM)**

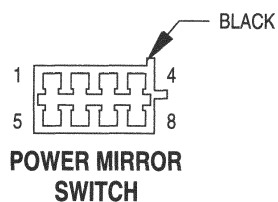
CAV	CIRCUIT	FUNCTION
1	M1 16PK/DB	FUSED B(+)
2	-	-
3	-	-
4	X58 18DB/OR	RIGHT REAR SPEAKER (-)
5	X84 18OR/BK	AMPLIFIED RIGHT INSTRUMENT PANEL SPEAKER (-)
6	X81 18YL/BK	AMPLIFIED LEFT INSTRUMENT PANEL SPEAKER (-)
7	X80 18LB/DG	AMPLIFIED RIGHT DOOR SPEAKER (-)
8	X85 18LG/DG	AMPLIFIED LEFT DOOR SPEAKER (-)
9	Z1 16BK/LB	GROUND
10	-	-
11	-	-
12	X52 18DB/WT	RIGHT REAR SPEAKER (+)
13	X57 18BR/LB	LEFT REAR SPEAKER (-)
14	X51 18BR/YL	LEFT REAR SPEAKER (+)
15	X86 18OR/RD	AMPLIFIED RIGHT INSTRUMENT PANEL SPEAKER (+)
16	X83 18YL/RD	AMPLIFIED LEFT INSTRUMENT PANEL SPEAKER (+)
17	X82 18LB/VT	AMPLIFIED RIGHT DOOR SPEAKER (+)
18	X87 18LG/VT	AMPLIFIED LEFT DOOR SPEAKER (+)



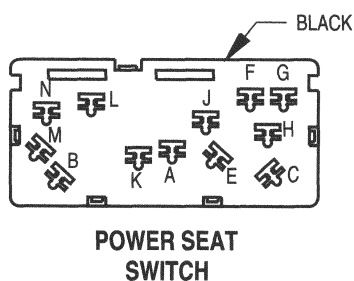
**POWER  
ANTENNA**

CAV	CIRCUIT	FUNCTION
1	M1 20PK/OR	FUSED B(+)
2	X60 20DG/RD	RADIO 12-VOLT OUTPUT
3	Z1 18BK	GROUND

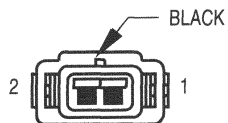




CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	F20 20WT	FUSED IGNITION SWITCH OUTPUT (RUN)
3	P94 20WT/YL	RIGHT POWER MIRROR HORIZONTAL DRIVER
4	P92 20YL/LB	RIGHT POWER MIRROR VERTICAL DRIVER
5	P90 20LG/BK	POWER MIRROR COMMON VERTICAL
	P90 20LG/BK	POWER MIRROR COMMON VERTICAL
6	P91 20WT/BK	POWER MIRROR COMMON HORIZONTAL
	P91 20WT/BK	POWER MIRROR COMMON HORIZONTAL
7	P95 20DB/WT	LEFT POWER MIRROR HORIZONTAL DRIVER
8	P93 20YL/BK	LEFT POWER MIRROR VERTICAL DRIVER

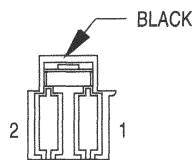


CAV	CIRCUIT	FUNCTION
A	F35 16RD	FUSED B (+)
B	Z1 16BK	GROUND
C	-	-
D	-	-
E	P21 16RD/LG	LEFT POWER SEAT FRONT DOWN
F	-	-
G	-	-
H	-	-
J	P19 16YL/LG	LEFT POWER SEAT FRONT UP
K	P15 16YL/LB	LEFT POWER SEAT HORIZONTAL FORWARD
L	P17 16RD/LB	LEFT POWER SEAT HORIZONTAL REARWARD
M	P13 16RD/WT	LEFT POWER SEAT REAR DOWN
N	P11 16YL/WT	LEFT POWER SEAT REAR UP



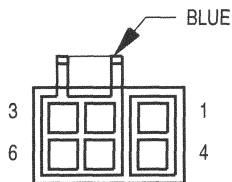
POWER  
STEERING  
PRESSURE  
SWITCH

CAV	CIRCUIT	FUNCTION
1	K10 18DB/LG	POWER STEERING PRESSURE SWITCH SENSE
2	Z1 18BK	GROUND



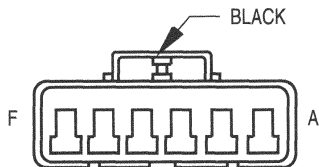
POWER TOP  
PUMP MOTOR

CAV	CIRCUIT	FUNCTION
1	P3 12YL	CONVERTIBLE TOP UP
2	P4 12RD	CONVERTIBLE TOP DOWN



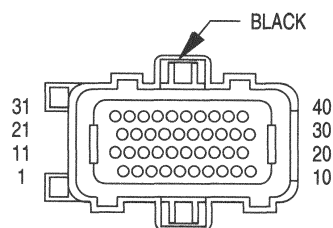
POWER TOP  
SWITCH

CAV	CIRCUIT	FUNCTION
1	P6 20RD/WT	CONVERTIBLE TOP UP RELAY B(+)
2	Z1 20BK	GROUND
3	-	-
4	Z1 20BK	GROUND
5	P5 20YL/BK	CONVERTIBLE TOP DOWN RELAY B(+)
6	P118 20WT	POWER TOP INHIBIT RELAY OUTPUT



POWER TOP  
UP/DOWN  
RELAYS

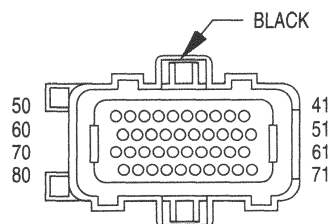
CAV	CIRCUIT	FUNCTION
A	P6 20RD/WT	CONVERTIBLE TOP UP RELAY B(+)
B	P3 12YL	CONVERTIBLE TOP UP
C	A25 12DB	FUSED B(+)
D	Z1 12BK	GROUND
E	P4 12RD	CONVERTIBLE TOP DOWN
F	P5 20YL/BK	CONVERTIBLE TOP DOWN RELAY B(+)



**POWERTRAIN  
CONTROL  
MODULE - C1**

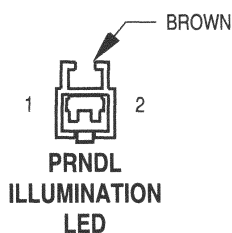
CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	K17 18DB/TN ■	IGNITION COIL NO. 2 DRIVER
4	K19 18BK/GY ■■	IGNITION COIL NO. 1 DRIVER
5	V32 20YL/RD	SPEED CONTROL POWER SUPPLY
6	A142 18DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
7	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
8	K20 18DG	GENERATOR FIELD
9	-	-
10	Z12 18BK/TN	GROUND
11	K19 18BK/GY ■	IGNITION COIL NO. 1 DRIVER
12	-	-
13	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
14	K58 18BR/DB ■■	FUEL INJECTOR NO. 6 DRIVER
15	K38 18GY ■■	FUEL INJECTOR NO. 5 DRIVER
16	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
17	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
18	-	-
19	-	-
20	F12 18DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
21	-	-
22	-	-
23	-	-
24	-	-
25	K42 18DB/LG ■	KNOCK SENSOR SIGNAL
26	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
27	K127 18BK/OR	OXYGEN SENSOR GROUND
28	-	-
29	-	-
30	K41 18BK/DG	OXYGEN SENSOR 1/1 SIGNAL
31	K90 18TN	STARTER RELAY CONTROL
32	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
33	K44 20TN/YL ■	CAMSHAFT POSITION SENSOR SIGNAL
	K44 18TN/YL ■■	CAMSHAFT POSITION SENSOR SIGNAL
34	-	-
35	K22 18OR/DB ■	THROTTLE POSITION SENSOR SIGNAL
35	K22 20OR/DB ■■	THROTTLE POSITION SENSOR SIGNAL
36	K1 18DG/RD	MAP SENSOR SIGNAL
37	K21 18BK/RD	INTAKE AIR TEMPERATURE SIGNAL
38	-	-
39	-	-
40	K35 18GY/YL	EGR SOLENOID CONTROL

■ 2.4L  
■■ 2.5L



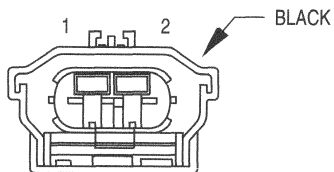
**POWERTRAIN  
CONTROL  
MODULE - C2**

CAV	CIRCUIT	FUNCTION
41	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
42	C18 20DB/YL	A/C PRESSURE SIGNAL
43	K4 20BK/LB	SENSOR GROUND
44	K7 18OR/WT	8V SUPPLY
45	K10 18DB/LG	POWER STEERING PRESSURE SWITCH SENSE
46	A14 16RD/TN	FUSED B(+)
47	Z11 18BK/WT	GROUND
48	K40 20BR/WT	IDLE AIR CONTROL MOTOR NO. 3 DRIVER
49	K60 20YL/BK	IDLE AIR CONTROL MOTOR NO. 2 DRIVER
50	Z12 18BK/TN	GROUND
51	K141 20TN/WT	OXYGEN SENSOR 1/2 SIGNAL
52	K118 18PK/YL	BATTERY TEMPERATURE SENSOR SIGNAL
53	-	-
54	-	-
55	C24 20DB/TN	LOW SPEED RADIATOR FAN RELAY CONTROL
56	V36 20WT/VT	SPEED CONTROL VACUUM SOLENOID CONTROL
57	K39 20GY/RD	IDLE AIR CONTROL MOTOR NO. 1 DRIVER
58	K59 20VT/BK	IDLE AIR CONTROL MOTOR NO. 4 DRIVER
59	D1 20VT/BR	CCD BUS (+)
60	D2 20WT/BK	CCD BUS (-)
61	K6 20VT/WT	5V SUPPLY
62	K29 18WT/RD	BRAKE SWITCH SENSE
63	T10 20YL/DG	TORQUE MANAGEMENT REQUEST SENSE
64	C28 20DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
65	D21 20PK/LG	SCI TRANSMIT
66	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
67	K51 20DB/VT	AUTOMATIC SHUT DOWN RELAY CONTROL
68	K52 20PK/GY	PROPORTIONAL PURGE SOLENOID CONTROL
69	C27 20DB/PK	HIGH SPEED RADIATOR FAN RELAY CONTROL
70	K108 18WT/TN	PWM PURGE SENSE
71	-	-
72	K107 18OR	LEAK DETECTION PUMP SWITCH SENSE
73	-	-
74	K31 20BR/LG	FUEL PUMP RELAY CONTROL
75	D20 20LG	SCI RECEIVE
76	T41 20BK/LB	TRS T41 SENSE
77	K106 18WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
78	-	-
79	-	-
80	V35 20LG/RD	SPEED CONTROL VENT SOLENOID CONTROL



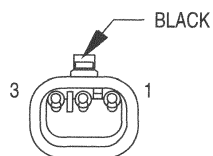
CAV	CIRCUIT	FUNCTION
1	E2 18OR/BK	PANEL LAMPS DRIVER
2	Z1 18BK	GROUND





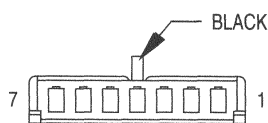
**PROPORTIONAL  
PURGE  
SOLENOID**

CAV	CIRCUIT	FUNCTION
1	K52 20PK/GY	PROPORTIONAL PURGE SOLENOID CONTROL
2	K108 18WT/TN	LINEAR PURGE SENSE



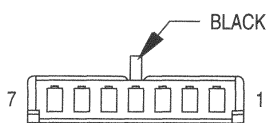
**RADIATOR  
FAN MOTOR  
ASSEMBLY**

CAV	CIRCUIT	FUNCTION
1	Z1 12BK	GROUND
2	C23 12DG/LG	LOW SPEED RADIATOR FAN RELAY OUTPUT
3	C25 12YL/RD	HIGH SPEED RADIATOR FAN RELAY OUTPUT



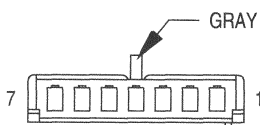
**RADIO - C1  
(PREMIUM)**

CAV	CIRCUIT	FUNCTION
1	X60 20DG/RD	RADIO 12V OUTPUT
2	X93 20WT/RD	LEFT REAR SPEAKER (+)
3	X94 20TN/RD	RIGHT REAR SPEAKER (+)
4	X53 20DG	LEFT FRONT SPEAKER (+)
5	X54 20VT	RIGHT FRONT SPEAKER (+)
6	X91 20WT/BK	LEFT REAR SPEAKER (-)
7	X92 20TN/BK	RIGHT REAR SPEAKER (-)



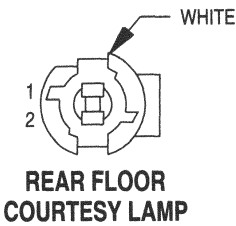
**RADIO - C1  
(STANDARD)**

CAV	CIRCUIT	FUNCTION
1	X60 20DG/RD	RADIO 12V OUTPUT
2	X51 18BR/YL	LEFT REAR SPEAKER (+)
3	X52 18DB/WT	RIGHT REAR SPEAKER (+)
4	X53 20DG	LEFT FRONT SPEAKER (+)
5	X54 20VT	RIGHT FRONT SPEAKER (+)
6	X57 18BR/LB	LEFT REAR SPEAKER (-)
7	X58 18DB/OR	RIGHT REAR SPEAKER (-)

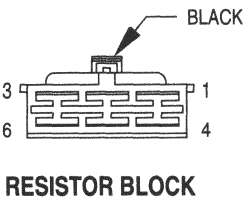


**RADIO - C2**

CAV	CIRCUIT	FUNCTION
1	-	-
2	X55 20BR/RD	LEFT FRONT SPEAKER (-)
3	X56 20DB/RD	RIGHT FRONT SPEAKER (-)
4	L7 18BK/DG	HEADLAMP SWITCH OUTPUT
5	E2 18OR/BR	PANEL LAMPS DRIVER
6	X12 18RD/WT	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
7	M1 18PK/WT	FUSED B(+)



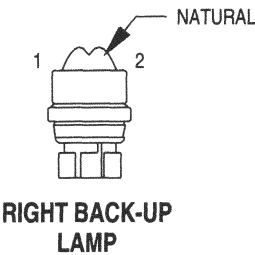
CAV	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	M2 18YL	ILLUMINATED ENTRY RELAY OUTPUT



CAV	CIRCUIT	FUNCTION
1	C7 12BK/TN	HIGH DRIVER BLOWER MOTOR
2	C6 18LB	M2 DRIVER BLOWER MOTOR
3	-	-
4	C1 12DG	BLOWER MOTOR FEED
5	C4 18TN	LOW DRIVER BLOWER MOTOR
6	C5 18LG	M1 DRIVER BLOWER MOTOR



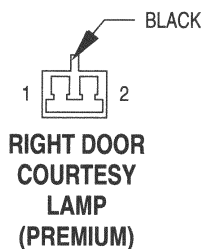
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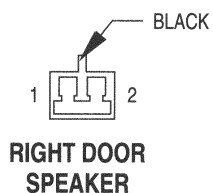
CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK UP LAMP FEED
2	Z1 18BK	GROUND



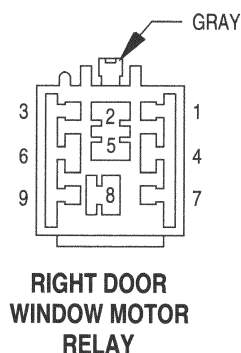
CAV	CIRCUIT	FUNCTION
1	G72 18DG/OR	RIGHT DOOR KEY CYLINDER SWITCH SENSE
2	M1 18PK	FUSED B(+)



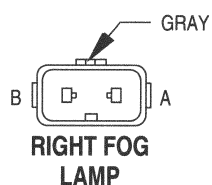
CAV	CIRCUIT	FUNCTION
1	M1 18PK	FUSED B(+)
2	M2 18YL	ILLUMINATED ENTRY RELAY OUTPUT



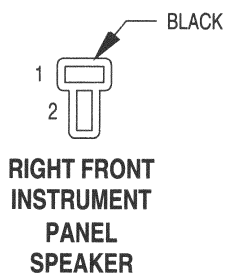
CAV	CIRCUIT	FUNCTION
1	X80 18LB/DG	RIGHT DOOR SPEAKER (-)
2	X82 18LB/VT	RIGHT DOOR SPEAKER (+)



CAV	CIRCUIT	FUNCTION
1	-	-
2	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
3	-	-
4	G10 20LG/RD	WINDOW MOTOR RELAY CONTROL
5	G10 20LG/RD	WINDOW MOTOR RELAY CONTROL
6	Q30 14VT	MASTER WINDOW SWITCH RIGHT FRONT DOWN
7	Z1 20BK	GROUND
8	Q26 14VT/WT	MASTER WINDOW SWITCH RIGHT FRONT DOWN
9	-	-

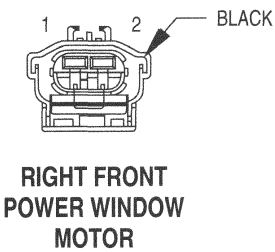


CAV	CIRCUIT	FUNCTION
A	L39 18LB	FOG LAMP SWITCH OUTPUT
B	Z1 18BK	GROUND

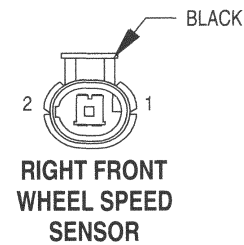


CAV	CIRCUIT	FUNCTION
1	X54 18VT •	RIGHT FRONT SPEAKER (+)
1	X84 18OR/BK ••	AMPLIFIED RIGHT INSTRUMENT PANEL SPEAKER (-)
2	X56 18DB/RD •	RIGHT FRONT SPEAKER (-)
2	X86 18OR/RD ••	AMPLIFIED RIGHT INSTRUMENT PANEL SPEAKER (+)

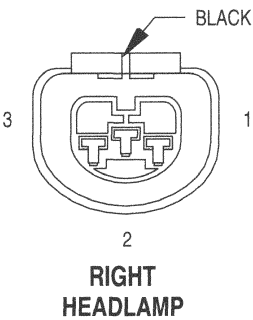
• STANDARD RADIO  
•• PREMIUM RADIO



CAV	CIRCUIT	FUNCTION
1	Q22 14VT	RIGHT FRONT WINDOW DRIVER (DOWN)
2	Q12 14BR	RIGHT FRONT WINDOW DRIVER (UP)

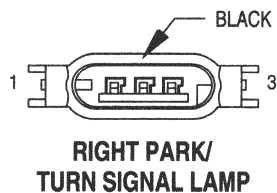


CAV	CIRCUIT	FUNCTION
1	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
2	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)



CAV	CIRCUIT	FUNCTION
1	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
2	Z1 18BK	GROUND
3	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT





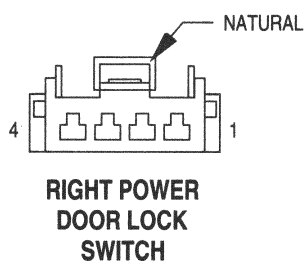
CAV	CIRCUIT	FUNCTION
1	L60 18TN/BR	RIGHT TURN SIGNAL
2	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
3	Z1 18BK	GROUND



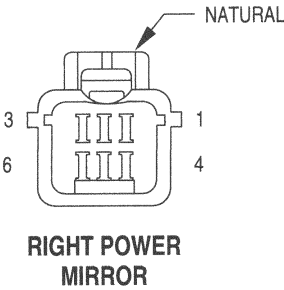
CAV	CIRCUIT	FUNCTION
1	P34 16PK/BK	RIGHT FRONT DOOR UNLOCK DRIVER
2	P33 16OR/BK	RIGHT FRONT DOOR LOCK DRIVER



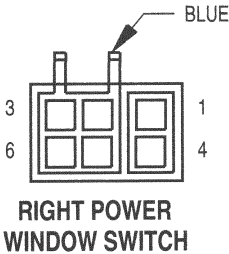
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CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B(+)
2	F20 20WT	FUSED IGNITION SWITCH OUTPUT (RUN)
3	Z1 20BK	GROUND
4	P96 20WT/LG	PASSENGERS DOOR SWITCH MUX



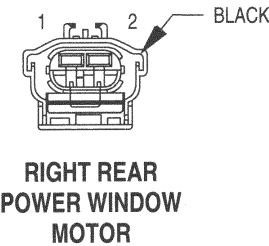
CAV	CIRCUIT	FUNCTION
1	P94 20WT/YL	RIGHT POWER MIRROR HORIZONTAL DRIVER
2	Z1 20BK	GROUND
3	C16 20LB/YL	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
4	P91 20WT/BK	POWER MIRROR COMMON HORIZONTAL
5	P90 20LG/BK	POWER MIRROR COMMON VERTICAL
6	P92 20YL/LB	RIGHT POWER MIRROR VERTICAL DRIVER



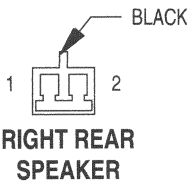
CAV	CIRCUIT	FUNCTION
1	Q22 14VT	RIGHT FRONT WINDOW DRIVER (DOWN)
2	Q16 14BR/WT	MASTER WINDOW SWITCH RIGHT FRONT UP
3	-	-
4	Q26 14VT/WT	MASTER WINDOW SWITCH RIGHT FRONT DOWN
5	Q12 14BR	RIGHT FRONT WINDOW DRIVER (UP)
6	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)



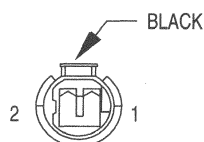
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
3	L60 18TN	RIGHT TURN SIGNAL



CAV	CIRCUIT	FUNCTION
1	Q28 14DG/WT	RIGHT REAR WINDOW DRIVER (DOWN)
2	Q18 14GY/BK	RIGHT REAR WINDOW DRIVER (UP)

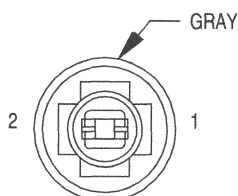


CAV	CIRCUIT	FUNCTION
1	X58 18DB/OR	RIGHT REAR SPEAKER (-)
2	X52 18DB/WT	RIGHT REAR SPEAKER (+)



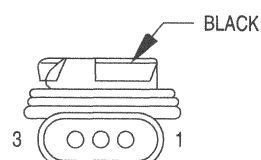
**RIGHT REAR  
WHEEL SPEED  
SENSOR**

CAV	CIRCUIT	FUNCTION
1	B1 20YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B2 20YL	RIGHT REAR WHEEL SPEED SENSOR (+)



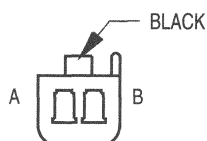
**RIGHT SIDE  
MARKER  
LAMP**

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
2	Z1 18BK	GROUND



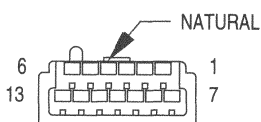
**RIGHT TAIL/  
STOP LAMP**

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 18BK/YL	HEADLAMP SWITCH OUTPUT
3	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT



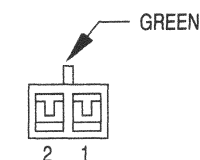
**RIGHT VISOR/  
VANITY LAMP**

CAV	CIRCUIT	FUNCTION
A	M1 18PK	FUSED B(+)
B	G38 18GY	BCM CONTROLLED ENABLE/DISABLE FEATURE



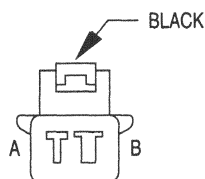
**SEAT BELT  
CONTROL  
MODULE**

CAV	CIRCUIT	FUNCTION
1	-	-
2	G75 18TN	LEFT DOOR AJAR SWITCH SENSE
3	G74 18TN/RD	RIGHT DOOR AJAR SWITCH SENSE
4	F13 18DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
5	A45 18BR	FUSED B(+)
6	Z1 18BK	GROUND
7	R7 18OR/BK	LEFT SEAT BELT SOLENOID CONTROL
8	R8 18OR/RD	RIGHT SEAT BELT SOLENOID CONTROL
9	-	-
10	-	-
11	-	-
12	-	-
13	Z2 18BK/LG	GROUND



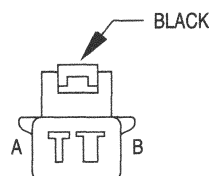
**SEAT BELT  
SWITCH**

CAV	CIRCUIT	FUNCTION
1	Z1 20BK/LG	GROUND
2	G10 20LG/RD	SEAT BELT SWITCH SENSE



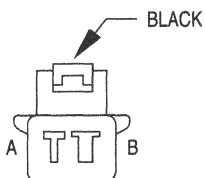
**SEAT FRONT  
VERTICAL MOTOR**

CAV	CIRCUIT	FUNCTION
A	P19 16YL/LG	LEFT POWER SEAT FRONT UP
B	P21 16RD/LG	LEFT POWER SEAT FRONT DOWN



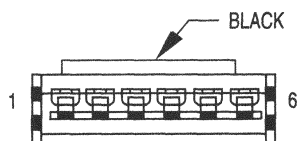
**SEAT  
HORIZONTAL  
MOTOR**

CAV	CIRCUIT	FUNCTION
A	P17 16RD/LB	LEFT POWER SEAT HORIZONTAL REARWARD
B	P15 16YL/LB	LEFT POWER SEAT HORIZONTAL FORWARD



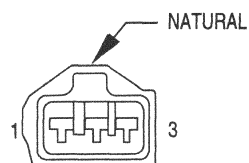
**SEAT REAR  
VERTICAL MOTOR**

CAV	CIRCUIT	FUNCTION
A	P13 16RD/WT	LEFT POWER SEAT REAR DOWN
B	P11 16YL/WT	LEFT POWER SEAT REAR UP



**SENTRY KEY  
IMMOBILIZER  
MODULE**

CAV	CIRCUIT	FUNCTION
1	D1 20VT/BR	CCD BUS(+)
2	D2 20WT/DB	CCD BUS(-)
3	-	-
4	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
5	Z1 20BK	GROUND
6	A15 20PK	FUSED B(+)

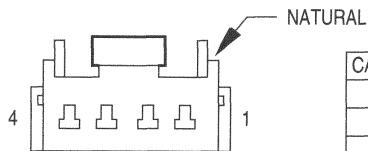


**THROTTLE  
POSITION  
SENSOR**

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB •	SENSOR GROUND
1	K6 18VT/WT ••	5V SUPPLY
2	K22 18OR/DB	THROTTLE POSITION SENSOR SIGNAL
3	K4 18BK/LB ••	SENSOR GROUND
3	K6 20VT/WT •	5V SUPPLY

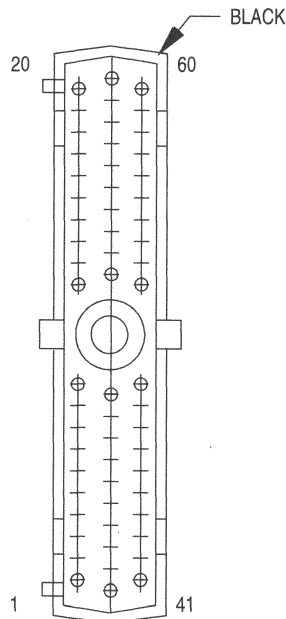
• 2.4L  
•• 2.5L





**TRACTION  
CONTROL SWITCH**

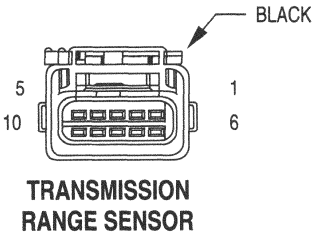
CAV	CIRCUIT	FUNCTION
1	B27 20RD/YL	TRACTION CONTROL SWITCH SENSE
2	Z1 20BK	GROUND
3	-	-
4	E2 20OR/YL	PANEL LAMPS FEED



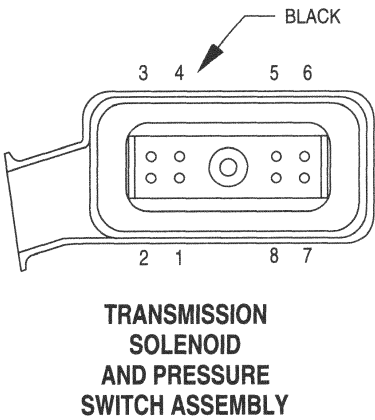
**TRANSMISSION  
CONTROL  
MODULE**

CAV	CIRCUIT	FUNCTION
1	T1 20LG/BK	TRS T1 SENSE
2	-	-
3	T3 18VT	TRS T3 SENSE
4	D2 20WT/DG	CCD BUS(-)
5	T5 20LG/LB	AUTOSTICK UPSHIFT SWITCH SENSE
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 20PK/LG	SCI TRANSMIT
8	A41 16YL/OR	IGNITION SWITCH OUTPUT (ST)
9	T9 20OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 20YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	F11 18RD/VT	FUSED IGNITION SWITCH OUTPUT (ST-RUN-OFF)
12	K22 20OR/LB	THROTTLE POSITION SENSOR SIGNAL
13	T13 20DB/BK	SPEED SENSOR GROUND
14	T14 20LG/WT	OUTPUT SPEED SENSOR SIGNAL
15	T15 20LG/YL	TRANSMISSION CONTROL RELAY CONTROL
16	T16 16RD/BR	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 16RD/BR	TRANSMISSION CONTROL RELAY OUTPUT
18	-	-
19	T19 20WT	2-4 SOLENOID CONTROL
20	T20 20LB	LOW/REVERSE SOLENOID CONTROL
41	T41 20BK/WT	TRS T41 SENSE
42	T42 18VT/TN	TRS T42 SENSE
43	D1 20VT/DG	CCD BUS(+)
44	T44 20YL/LB	AUTOSTICK DOWNSHIFT SWITCH SENSE
45	-	-
46	D6 20PK/LB	SCI RECEIVE
47	T47 20YL/BK	2-4 PRESSURE SWITCH SENSE
48	-	-
49	-	-
50	T50 18DG/TN	LOW/REVERSE PRESSURE SWITCH SENSE
51	K4 20BK/LB	SENSOR GROUND
52	T52 20RD/BK	INPUT SPEED SENSOR SIGNAL
53	Z14 18BK/YL	GROUND
54	T54 18VT/WT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	-	-
56	A24 16PK/YL	FUSED B(+)
57	Z13 16BK/RD	GROUND
58	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
59	T59 18PK/DB	UNDERDRIVE SOLENOID CONTROL
60	T60 18BR/TN	OVERDRIVE SOLENOID CONTROL

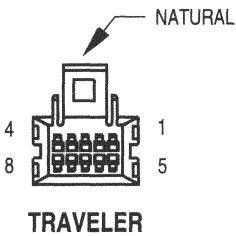
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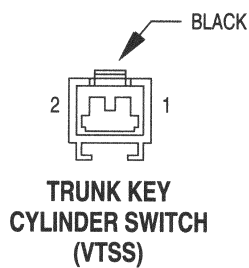
CAV	CIRCUIT	FUNCTION
1	F20 18WT/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
2	-	-
3	T13 18DB/BR	SPEED SENSOR GROUND
4	T54 18VT/WT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
5	T41 18BK/LB	TRS T41 SENSE
6	L1 18VT/BK	BACK-UP LAMP FEED
7	T1 18LG/GY	TRS T1 SENSE
8	T3 18VT	TRS T3 SENSE
9	T42 18VT/TN	TRS T42 SENSE
10	T41 18BK/WT	TRS T41 SENSE



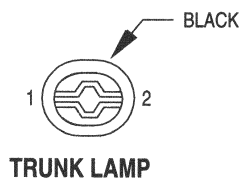
CAV	CIRCUIT	FUNCTION
1	T47 18YL/GY	2-4 PRESSURE SWITCH SENSE
2	T50 18DG/TN	LOW/REVERSE PRESSURE SWITCH SENSE
3	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
4	T16 16RD/BR	TRANSMISSION CONTROL RELAY OUTPUT
5	T59 18PK/DB	UNDERDRIVE SOLENOID CONTROL
6	T60 18BR/TN	OVERDRIVE SOLENOID CONTROL
7	T20 18LB/WT	LOW/REVERSE SOLENOID CONTROL
8	T19 18WT/PK	2-4 SOLENOID CONTROL



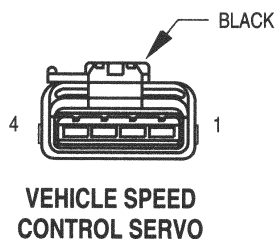
CAV	CIRCUIT	FUNCTION
1	D1 20VT	CCD BUS (+)
2	D2 20WT/BK	CCD BUS (-)
3	-	-
4	-	-
5	Z1 20BK	GROUND
6	F18 20LG/BK	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
7	M1 20PK	FUSED B(+)
8	-	-



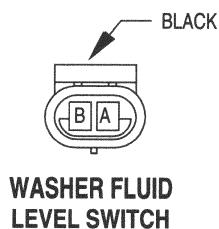
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	G71 20VT/YL	TRUNK KEY CYLINDER SENSE



CAV	CIRCUIT	FUNCTION
1	M1 20PK/VT	FUSED B(+)
2	G78 20TN/BK	DECKLID AJAR SWITCH SENSE



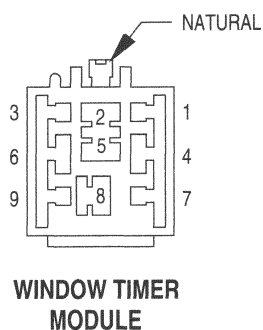
CAV	CIRCUIT	FUNCTION
1	V36 20WT/VT	SPEED CONTROL VACUUM SOLENOID CONTROL
2	V35 20LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
3	V30 20DB/RD	SPEED CONTROL BRAKE SWITCH OUTPUT
4	Z1 20BK	GROUND



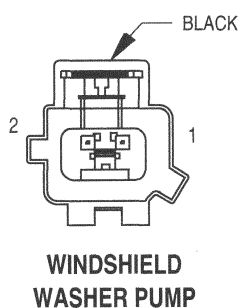
CAV	CIRCUIT	FUNCTION
A	Z1 20BK	GROUND
B	G29 20BK/TN	WASHER FLUID SWITCH SENSE



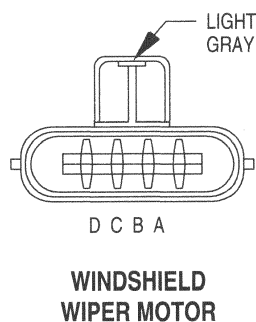
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CAV	CIRCUIT	FUNCTION
1	P5 20YL/RD	CONVERTIBLE TOP DOWN RELAY B(+)
2	F21 14TN	FUSED IGNITION SWITCH OUTPUT (RUN)
3	P6 20RD/WT	CONVERTIBLE TOP UP RELAY B(+)
4	Q27 14RD/BK	LEFT RIGHT WINDOW DRIVER (DOWN)
5	Q32 14BR	RIGHT REAR WINDOW DRIVER (DOWN) (SWITCH)
6	Q28 14DG/WT	RIGHT REAR WINDOW DRIVER (DOWN)
7	G10 20LG/RD	WINDOW MOTOR RELAY CONTROL
8	Q31 14OR	LEFT REAR WINDOW DRIVER (DOWN) (SWITCH)
9	Z1 20BK	GROUND



CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	V10 18BR/DB	WASHER PUMP CONTROL SWITCH OUTPUT



CAV	CIRCUIT	FUNCTION
A	V4 14RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
B	V3 14BR/OR	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
C	Z1 16BK	GROUND
D	V55 20TN/RD	WIPER PARK SWITCH SENSE



## 8W-90 CONNECTOR/GROUND LOCATIONS

### DESCRIPTION AND OPERATION

#### INTRODUCTION

This section provides illustrations identifying the general location of components, grounds, and connectors in the vehicle. A index is provided. Use the wiring diagrams in each section for connector/ground

number identification. Refer to the index for the proper figure number.

#### CONNECTOR/GROUND LOCATIONS

For items not shown in this section a N/S is placed in the Fig. column

Connector Name/Number	Color	Location	Fig.
A/C Compressor Clutch	GY	Top of Compressor	5, 6, 9, 10
A/C Evaporator Temperature Sensor	BK	Right Side of HVAC	15, 17
A/C-Heater Control C1	NAT	Rear of Control	15, 17
A/C-Heater Control C2	BK	Rear of Control	15, 17
A/C Pressure Transducer	GY	Top of A/C Compressor	6, 9, 10
Airbag Control Module C1	GY	At Module	14, 20
Airbag Control Module C2	YL	At Module	14, 20
Ash Receiver Lamp	BK	Rear of Lamp	N/S
Automatic Day/Night Mirror	BK	At Mirror	18
Autostick Switch	NAT	Base of Shifter	14
Back-Up Lamp Switch	GY	Rear of Transmission	12
Battery Temperature Sensor	GY	Near Battery	N/S
Body Control Module C1	BK	At Module	16
Body Control Module C2	NAT	At Module	15
Body Control Module C3	NAT	At Module	15
Body Control Module C4	NAT	At Module	15
Body Control Module C5	BK	At Module	16

Connector Name/Number	Color	Location	Fig.
Brake Fluid Level Switch	BK	On Master Cylinder	N/S
Brake Lamp Switch	GY	Top of Brake Pedal	19
Brake Shift Interlock Solenoid		Left Side Instrument Panel Lower Steering Column	N/S
C104	LT/GY	Under PDC	1
C105	BK	Under PDC	1
C111	BK	Rear of PCM	N/S
C113	LT/GY	Rear of PCM	N/S
C121	GN	Left Side Cowl Panel	19
C126	BL	Near Junction Block	15, 16
C127		Near Junction Block	15
C165 (2.5L)	BK	Left Side of Intake	11
C169	BK	Manual Transmission to Headlamp and Dash Harness	N/S
C224	GY	Left Side of Steering Column	N/S
C300	BK	Trunk	21
C301	BK	RT Quarter Panel	N/S
C305	RD	Near Trunk Latch	21
C309	GY	Under Seat	20
C310	BR	Left A-Pillar	23

**DESCRIPTION AND OPERATION (Continued)**

Connector Name/Number	Color	Location	Fig.
C311	BL	Left A-Pillar	23
C315	BR	Right A-Pillar	24
C316	BL	Right A-Pillar	24
C332	BK	Left Side Cowl	18
C340	BK	Under Drivers Seat	20
C341	GN	Under Passengers Seat	20
C342	BK	Front of Floor Console	20
Camshaft Position Sensor	BK	Left Side of Cyl Head	4
Center High Mounted Stop Lamp	BK	At Lamp	21
Clockspring No.1	NAT	Rear of Clockspring	14
Clockspring No.2	YL	Rear of Clockspring	14
Clutch Interlock Switch	BK	Top of Clutch Pedal Bracket	N/S
Controller Anti-Lock Brake	BK	Right Fender Side Shield	1
Crankshaft Position Sensor 2.4L	BK	Rear of Cyl Block	7
Crankshaft Position Sensor 2.5L	BK	Under Distributor	10
Data Link Connector	BK	LT Side of Steering Column	15, 16
Decklid Release Relay	BK	RT of Steering Column	19
Decklid Release Switch	BK	Center Console	N/S
Decklid Solenoid	BK	On Decklid Latch	22
Distributor C1	BK	On Distributor	10
Distributor C2	BK	On Distributor	10
Driver Seat Belt Solenoid	NAT	In Seat	N/S
EGR Solenoid	BK	At Solenoid	7, 9
Engine Coolant Temperature Sensor	BK	At Sensor	4, 8

Connector Name/Number	Color	Location	Fig.
Front Vertical Motor	BK	At Motor	N/S
Fuel Injector No.1 (2.4L)	BK	At Injector	4
Fuel Injector No.1 (2.5L)	BK	At Injector	N/S
Fuel Injector No.2 (2.4L)	BK	At Injector	4
Fuel Injector No.2 (2.5L)	BK	At injector	8
Fuel Injecotr No.3 (2.4L)	BK	At Injector	4
Fuel Injector No.3 (2.5L)	BK	At Injector	N/S
Fuel Injector No.4 (2.4L)	BK	At Injector	4
Fuel Injector No.4 (2.5L)	BK	At Injector	8
Fuel Injector No.5 (2.5L)	BK	At Injector	N/S
Fuel Injector No.6 (2.5L)	BK	At Injector	8
Fuel Pump Module	BK	Right Side of Trunk Area	22
G100		Left Strut Tower	1
G102		Left Strut Tower	1
G103		Right Strut Tower	1
G105		Left Front of Engine	9
G111		Left Strut Tower	N/S
G200		Right I. P. Center Support	15
G201		Base of Gearshift	14, 20
G300		Left Side of Trunk Opening	21
G301		Left Side Cowl	19
G302		Center of Deck Lid	22
G303		Right Rear Quarter Panel	21
G304		Base of Gearshift	20
G306		Base of Gearshift	N/S

**DESCRIPTION AND OPERATION (Continued)**

Connector Name/Number	Color	Location	Fig.
G307		Trunk	21
Generator	BK	Rear of Generator	6, 9, 10
Glove Box Lamp	BK	At Lamp	15
High Note Horn	BK	Right Front Fender	3
Horizontal Motor	BK	At Motor	N/S
Idle Air Control Motor	BK	On Throttle Body	5, 8
Ignition Coil Pack	BK	Top of Valve Cover	4
Ignition Switch C1	BK	At Switch	14
Ignition Switch C2	BK	At Switch	14
Illuminated Entry Relay	BK	Right of Steering Column	19
Instrument Cluster C1	RD	Rear of Cluster	15
Instrument Cluster C2	BL	Rear of Cluster	15
Input Speed Sensor	GY	At Transmission	13
Intake Air Temp Sensor	GY	Rear of Intake	6, 11
Junction Block C1	BR	At Junction Block	16
Junction Block C2	NAT	At Junction Block	16
Junction Block C3	WT	At Junction Block	16
Junction Block C4	BL	At Junction Block	15
Junction Block C5	GY	At Junction Block	15
Junction Block C6	WT	At Junction Block	15
Junction Block C7	NAT	At Junction Block	15
Junction Block C8	BK	At Junction Block	16
Junction Block C9	WT	At Junction Block	16
Junction Block C10	NAT	At Junction Block	N/S

Connector Name/Number	Color	Location	Fig.
Key-In Switch	GN	At Switch	14
Left Back-Up Lamp	NAT	At Lamp	N/S
Left Door Arm/Disarm Switch	BK	At Switch	N/S
Left Door Courtesy Lamp	BK	At Lamp	23
Left Door Speaker	BK	Left Door	23
Left Door Window Motor Relay	GY	Left Door	N/S
Left Fog Lamp	GY	At Lamp	1
Left Front Instrument Panel Speaker	BK	At Speaker	15
Left Front Power Window Motor	BK	At Motor	23
Left Front Wheel Speed Sensor	BK	Left Fender Side Shield	N/S
Left Headlamp	BK	At Lamp	N/S
Left Park/Turn Signal Lamp	BK	At Lamp	N/S
Left Power Door Lock Motor	GY	Left Door	23
Left Power Door Lock Switch	WT	Left Door	23
Left Power Mirror	NAT	At Mirror	23
Left Rear Park/Turn Signal Lamp	BK	At Lamp	N/S
Left Rear Power Window Motor	BK	At Motor	N/S
Left Rear Speaker	BK	At Speaker	N/S
Left Rear Wheel Speed Sensor	BK	Left Quarter Panel	22
Left Side Marker Lamp	GY	At Lamp	N/S
Left Tail/Stop Lamp	BK	At Lamp	21
Left Visor/Vanity Lamp	BK	At Lamp	18



**DESCRIPTION AND OPERATION (Continued)**

Connector Name/Number	Color	Location	Fig.
License Lamp	NAT	At Lamp	N/S
Low Note Horn	BK	Right Front Fender	3
Manifold Absolute Pressure Sensor	BK	Rear of Intake	5, 11
Master Power Window Switch	BL	At Switch	23
Mode Door Actuator	NAT	Left Side of HVAC	17
Multi-Function Switch C1	BK	Left Side of Switch	14
Multi-Function Switch C2	BL	Right Side of Switch	14
Oil Pressure Switch	GN	At Switch	7, 10, 11
Output Speed Sensor	GY	Front of Transmission	13
Overhead Map Lamp	BK	At Lamp	18
Oxygen Sensor 1/1 Upstream	BK	At Upstream Oxygen Sensor	7, 11
Oxygen Sensor 1/2 Downstream	NAT	At Downstream Oxygen Sensor	1
Passenger Seat Belt Solenoid	NAT	In Seat	N/S
Passenger Side Airbag	YL	At Airbag	15
Power Amplifier C1	WT	At Amplifier	14, 20
Power Amplifier C2	WT	At Amplifier	14, 20
Power Mirror Switch	BK	At Switch	23
Power Seat Switch	BK	Under Seat	20
Power Steering Pressure Switch	BL	Left Side of Steering Gear	1
Power Top Pump Motor	BK	Front Center of Trunk Area	22
Power Top Switch	BL	Center Console	N/S
Power Top Up/Down Relays	BK	Front Center of Trunk Area	22

Connector Name/Number	Color	Location	Fig.
Powertrain Control Module C1	BK	Side of PDC	1
Powertrain Control Module C2	BK	Side of PDC	1
Proportional Purge Solenoid	BK	At Solenoid	3
PRNDL Illumination LED	BR	Base of Gearshifter	N/S
Radiator Fan Motor Assembly	BK	Rear of Motor	N/S
Radio C1	BK	Rear of Radio	14
Radio C2	GY	Rear of Radio	14
Rear Floor Courtesy Lamp	WT	At Lamp	N/S
Rear Vertical Motor	BK	At Motor	N/S
Resistor Block	BK	Right Side Instrument Panel	15, 17
Right Back-Up Lamp	NAT	At Lamp	N/S
Right Door Arm/Disarm Switch	GY	At Switch	24
Right Door Courtesy Lamp	BK	At Lamp	24
Right Door Speaker	BK	At Speaker	24
Right Door Window Motor Relay	GY	In Left Door	N/S
Right Fog Lamp	GY	At Lamp	3
Right Front Instrument Panel Speaker	BK	At Speaker	15
Right Front Power Window Motor	BK	At Motor	24
Right Front Wheel Speed Sensor	BK	Right Fender Side Shield	1
Right Headlamp	BK	At Lamp	3
Right Park/Turn Signal Lamp	BK	At Lamp	3

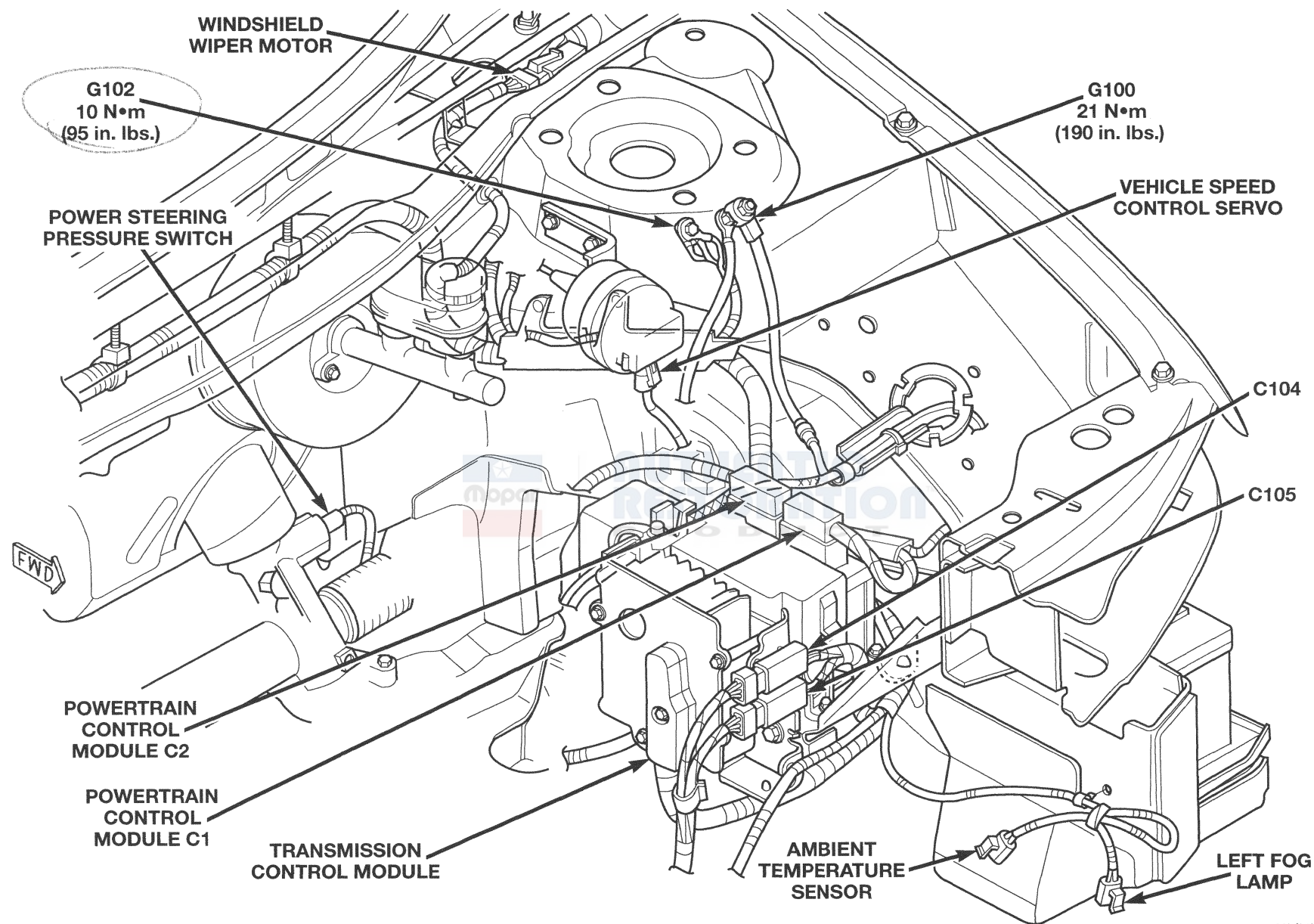


**DESCRIPTION AND OPERATION (Continued)**

Connector Name/Number	Color	Location	Fig.
Right Power Door Lock Motor	GY	Right Door	24
Right Power Door Lock Switch	NAT	Right Door	24
Right Power Mirror	NAT	At Mirror	24
Right Power Window Switch	BL	At Motor	24
Right Rear Park/Turn Signal Lamp	BK	At Lamp	N/S
Right Rear Power Window Motor	BK	At Motor	24
Right Rear Speaker	BK	At Speaker	N/S
Right Rear Wheel Speed Sensor	BK	Right Side Trunk Area	22
Right Side Marker Lamp	GY	At Lamp	N/S
Right Tail/Stop Lamp	BK	At Lamp	N/S
Right Visor/Vanity Lamp	BK	At Lamp	18
Seat Belt Control Module	NAT	Rear of Center Console	20
Seat Belt Switch	GN	In Buckle	N/S
Sentry Key Immobilizer Module	BK	Steering Column	14

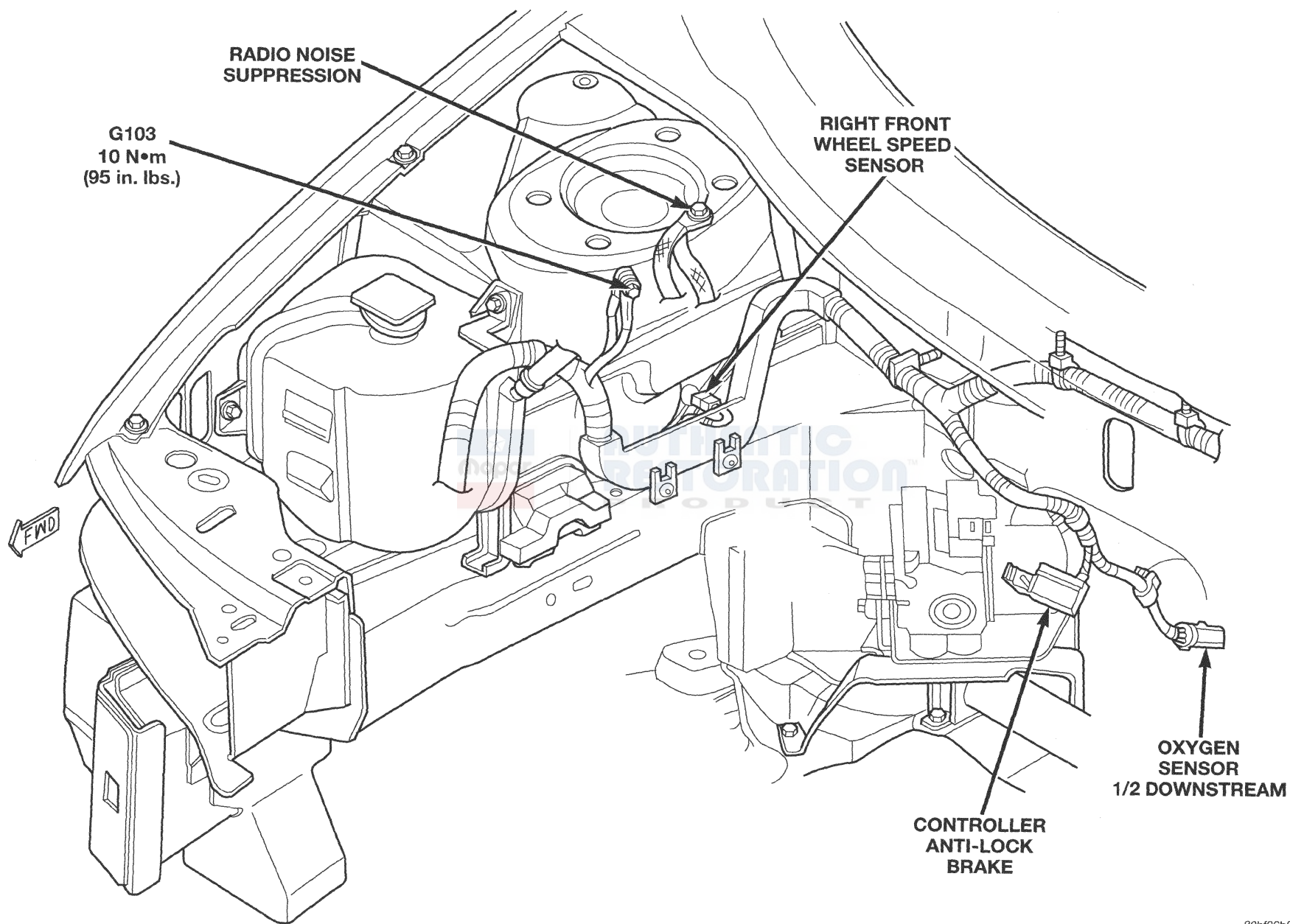
Connector Name/Number	Color	Location	Fig.
Throttle Position Sensor	BK	On Throttle Body	5, 8
Traction Control Switch	NAT	Steering Column	14
Transmission Control Module	BK	Next to PDC	1
Transmission Range Sensor	BK	Front of Transmission	13
Transmission Solenoid and Pressure Switch Assembly	BK	Front of Transmission	13
Traveler	BK	Rear of Traveler	15
Trunk Key Cylinder Switch	BK	At Switch	22
Trunk Lamp	BK	At Lamp	21
Vehicle Speed Control Servo	BK	At Servo	1
Vehicle Speed Sensor	BK	Front of Transmission	12
Washer Fluid Level Switch	BK	Washer Reservoir	N/S
Window Timer Module	NAT	Left Front Door	N/S
Windshiel Washer Pump	BK	Bottom of Reservoir	3
Windshield Wiper Motor	LT/GY	Left Strut Tower	1

**DESCRIPTION AND OPERATION (Continued)**



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**Fig. 1 Engine Compartment Connections (Left Side)**



**Fig. 2 Engine Compartment Connections (Right Side)**

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DESCRIPTION AND OPERATION (Continued)

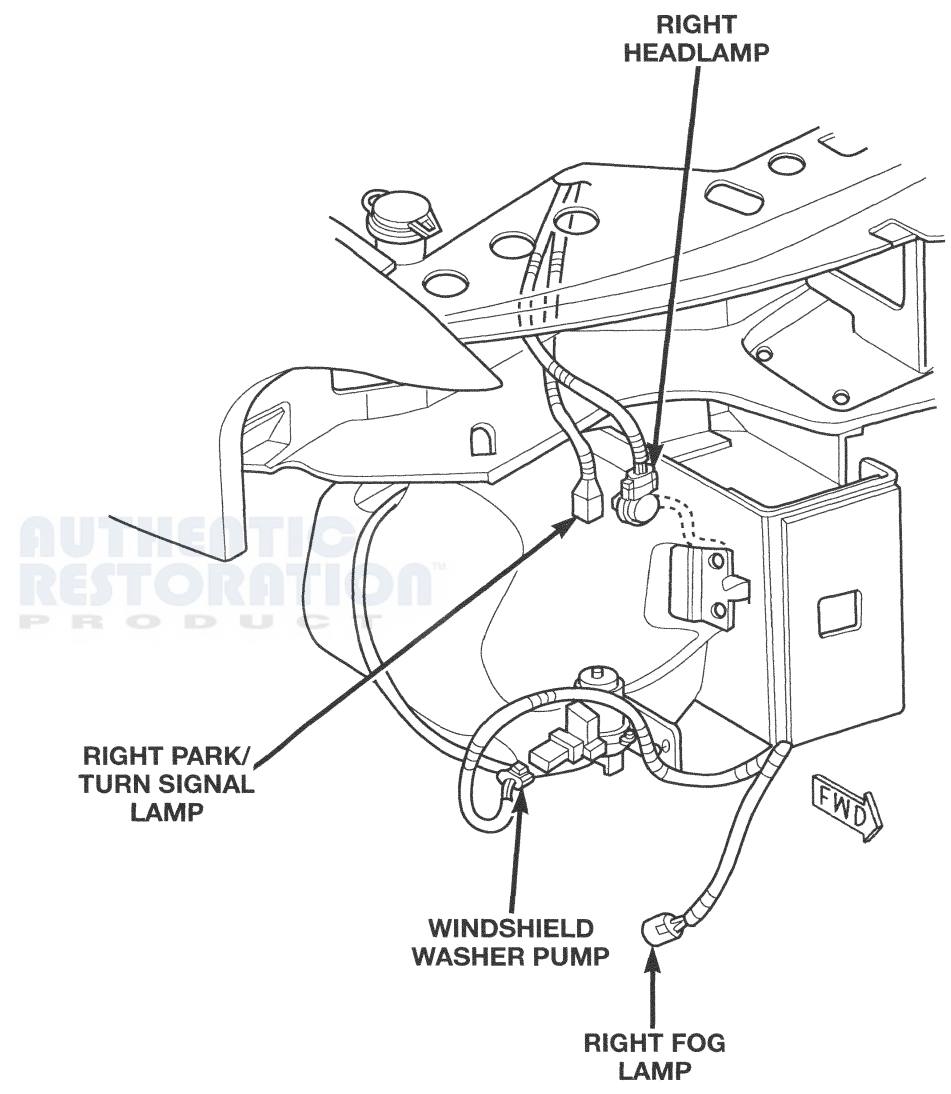
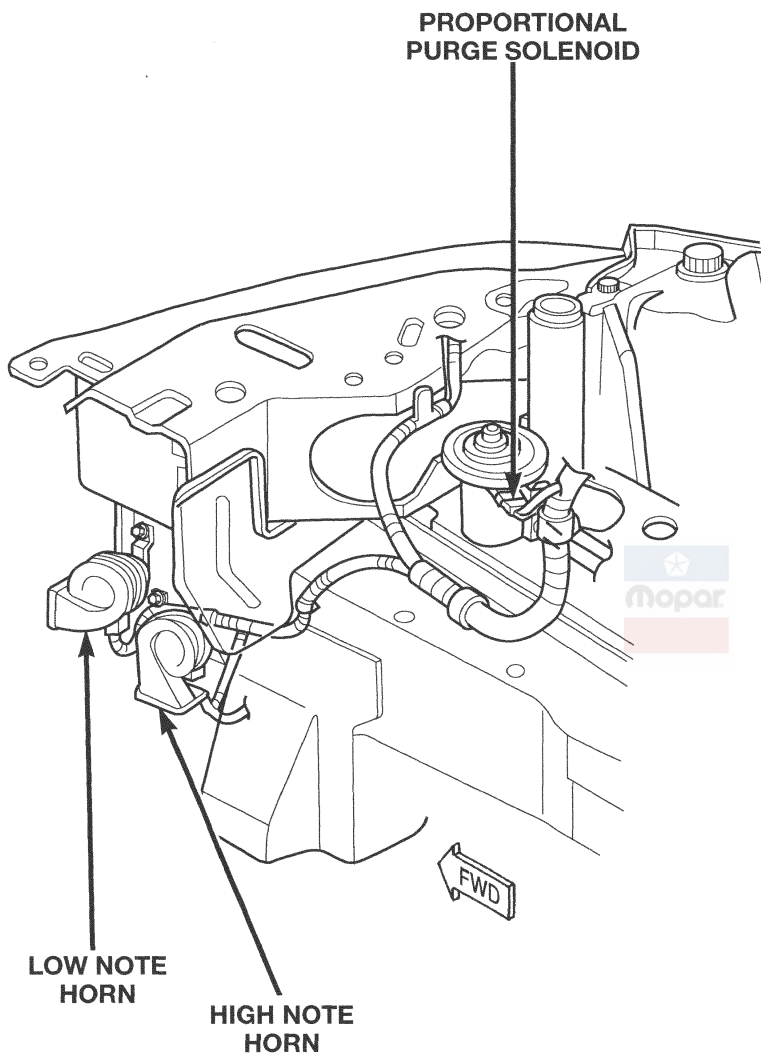
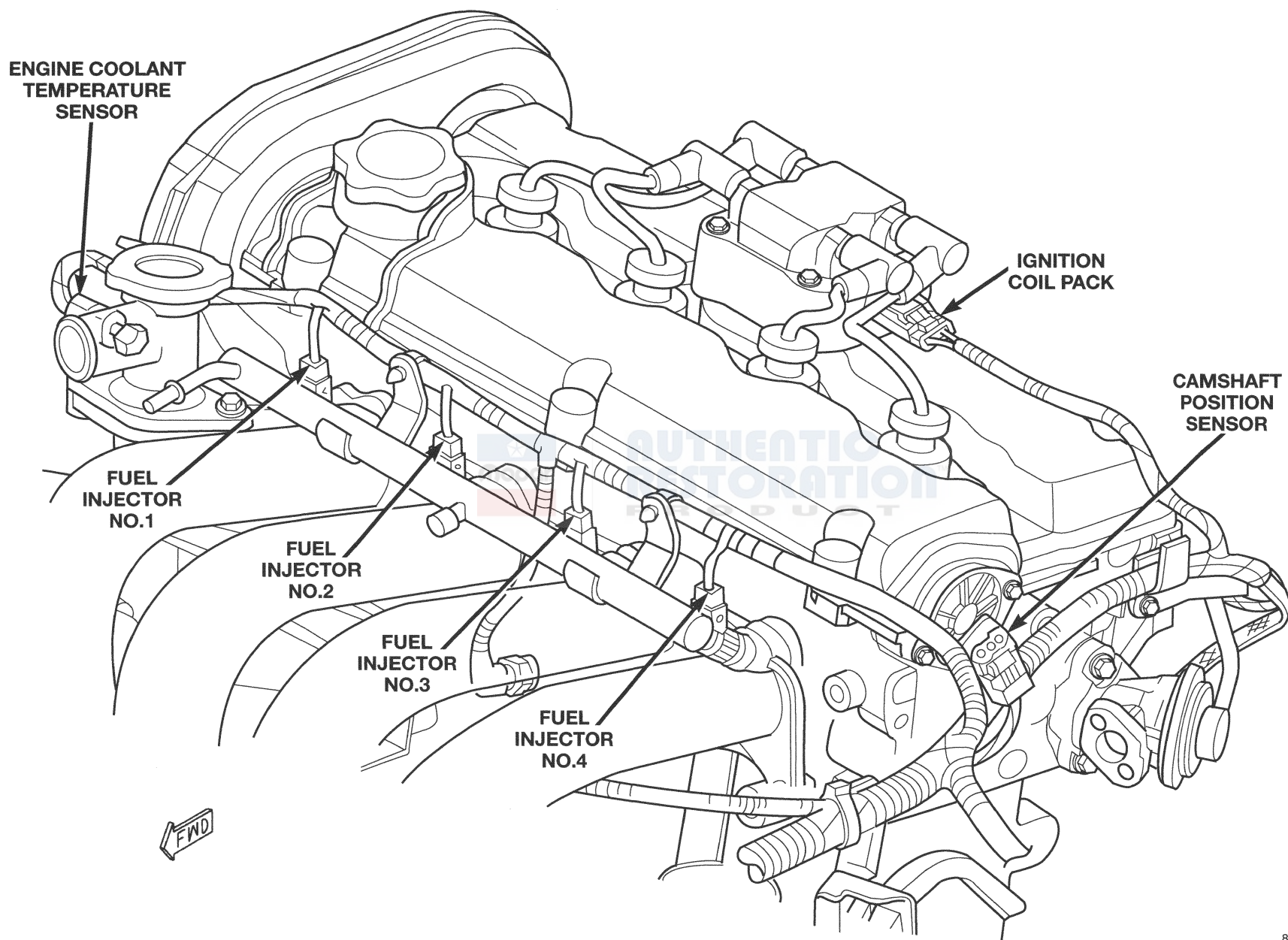


Fig. 3 Right Headlamp Connectors

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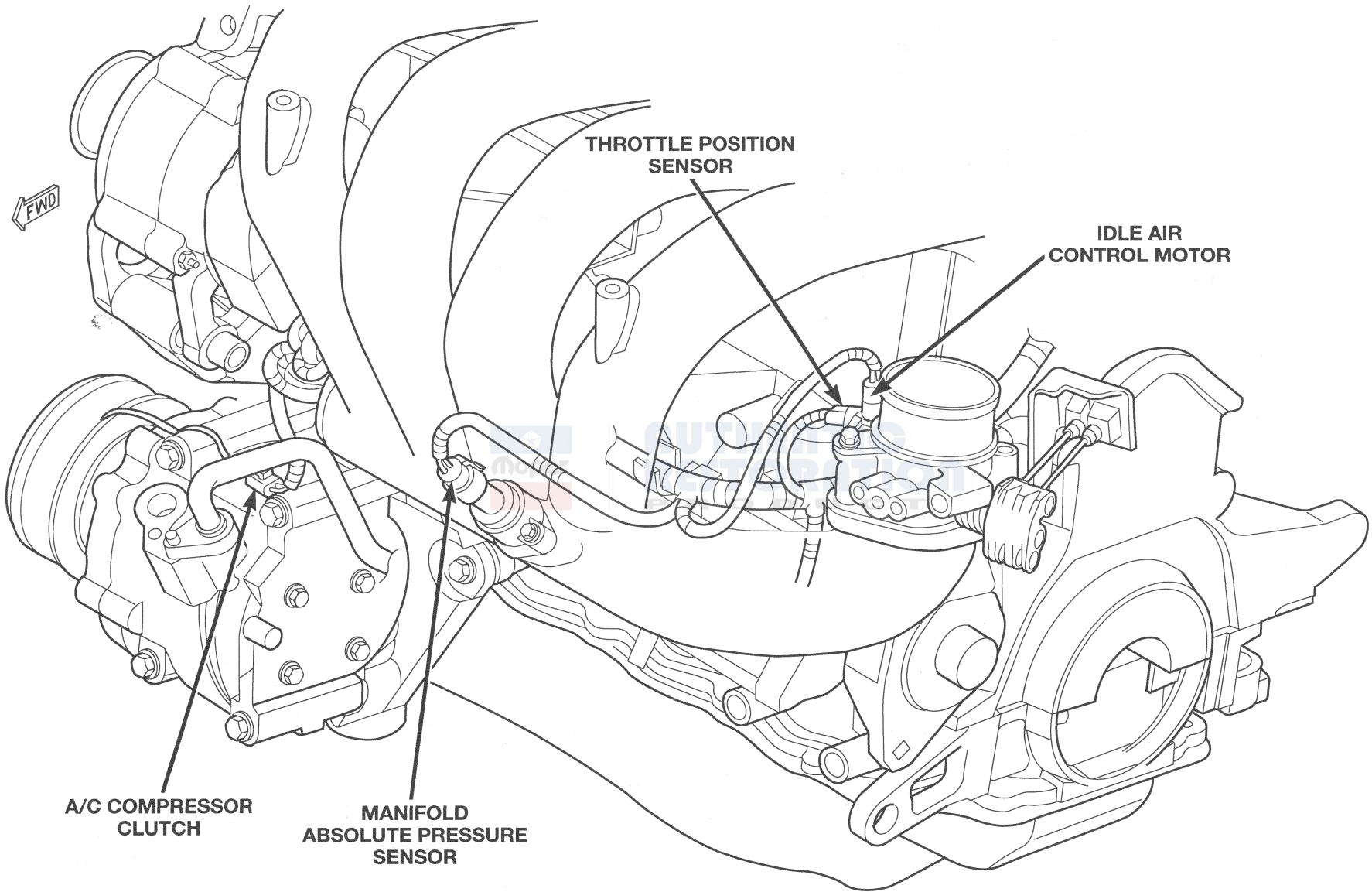
**DESCRIPTION AND OPERATION (Continued)**



**Fig. 4 2.4L Fuel Injector Connectors**

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**DESCRIPTION AND OPERATION (Continued)**



**Fig. 5 2.4L Engine Front**

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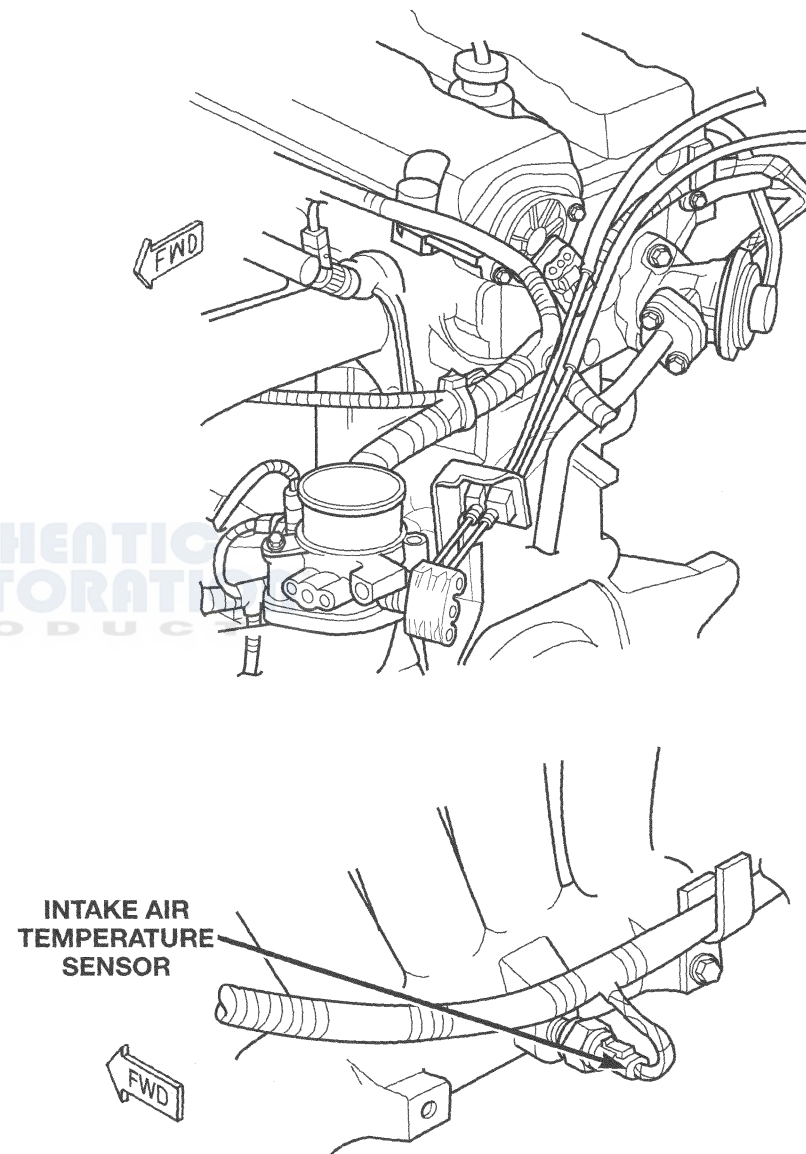
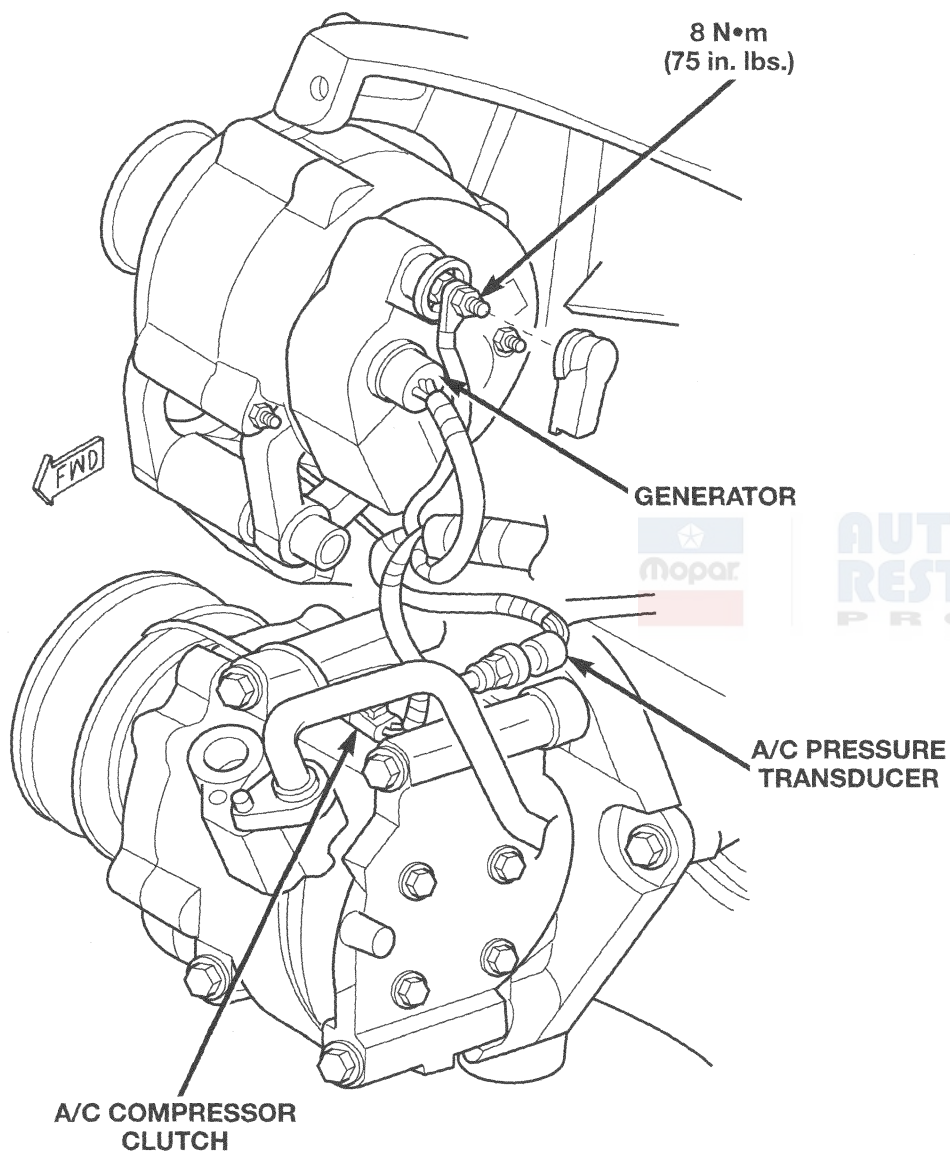
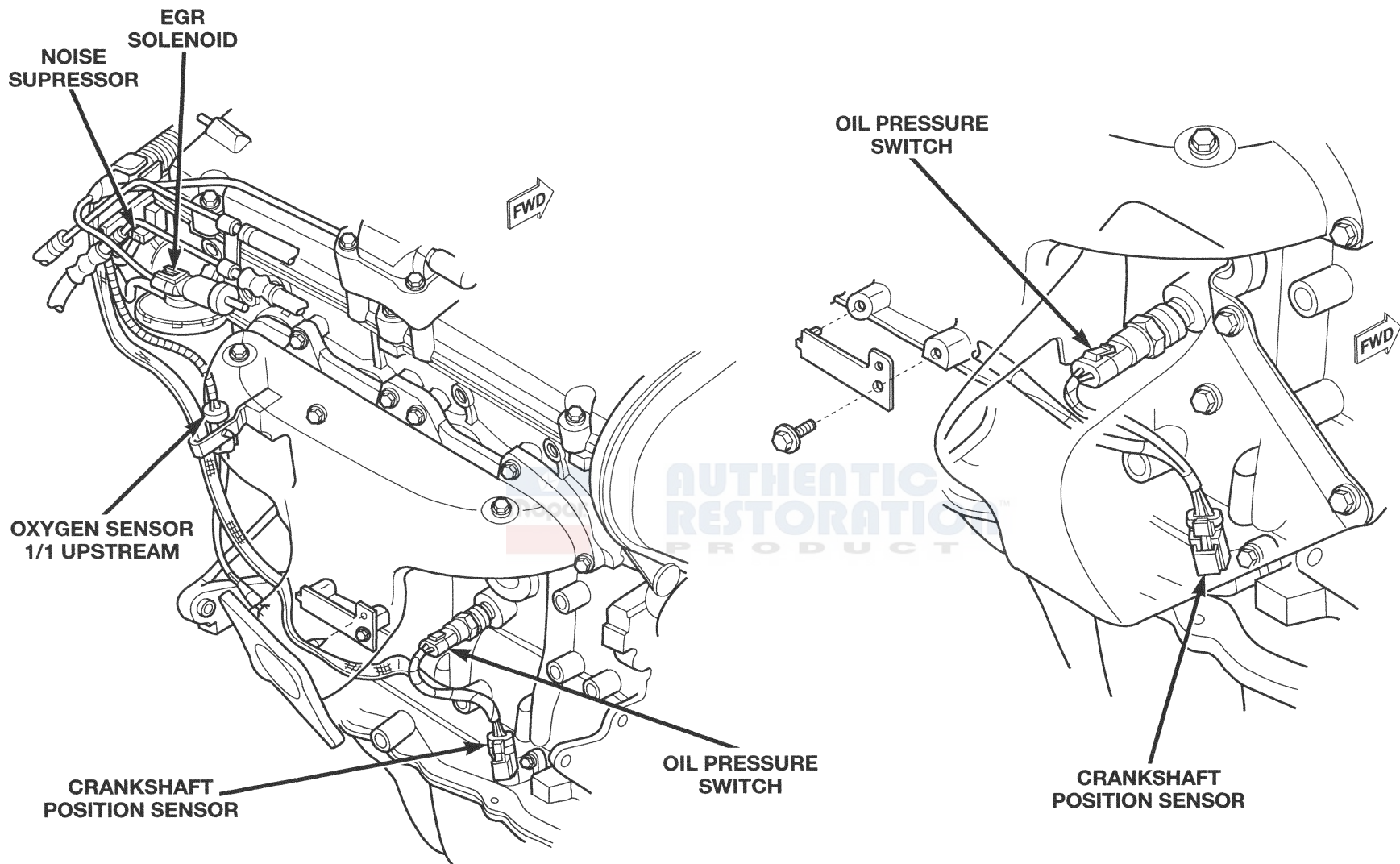


Fig. 6 2.4L Engine Generator and A/C Compressor

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**DESCRIPTION AND OPERATION (Continued)**

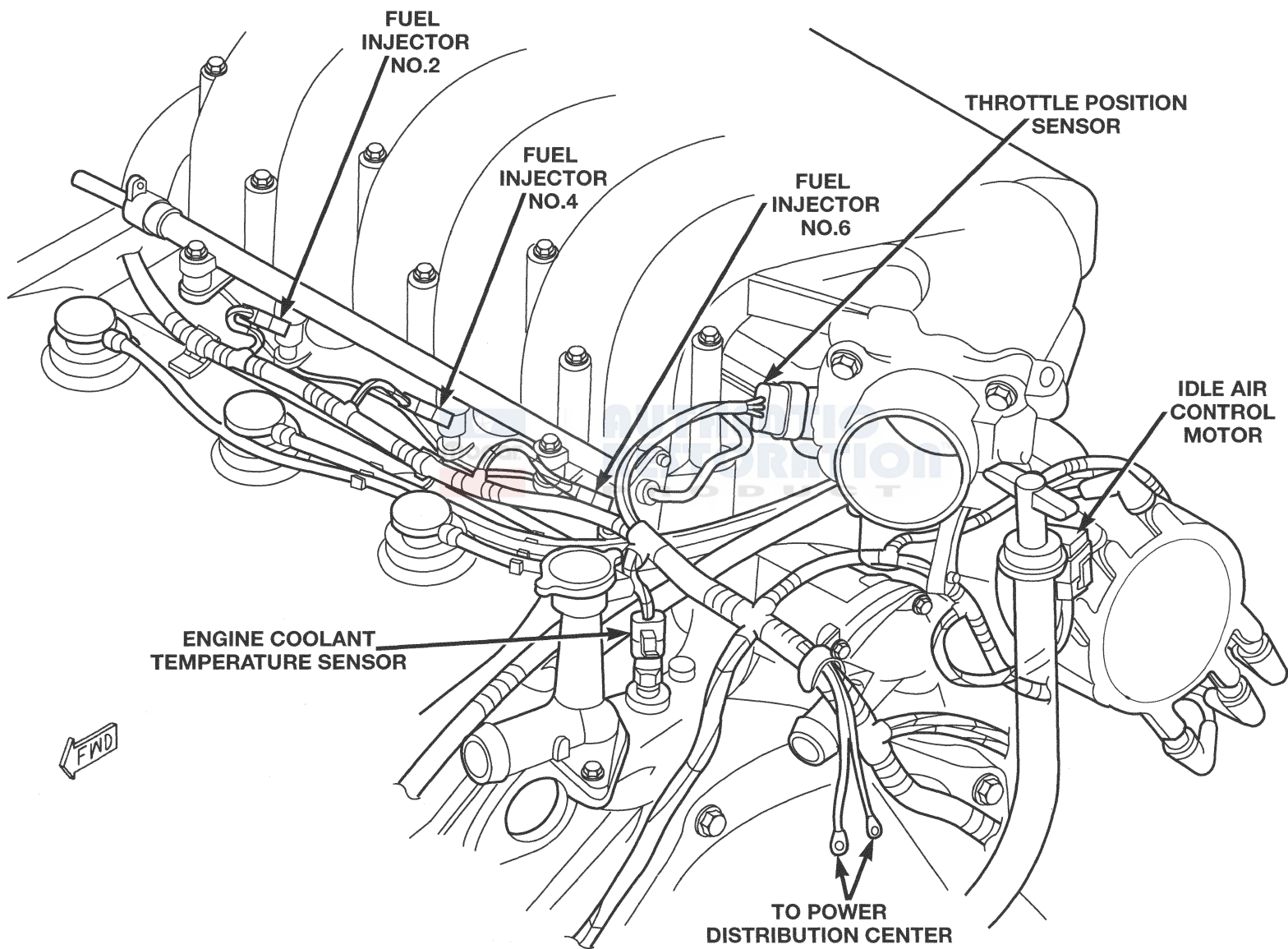


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**Fig. 7 2.4L Engine Rear Connectors**



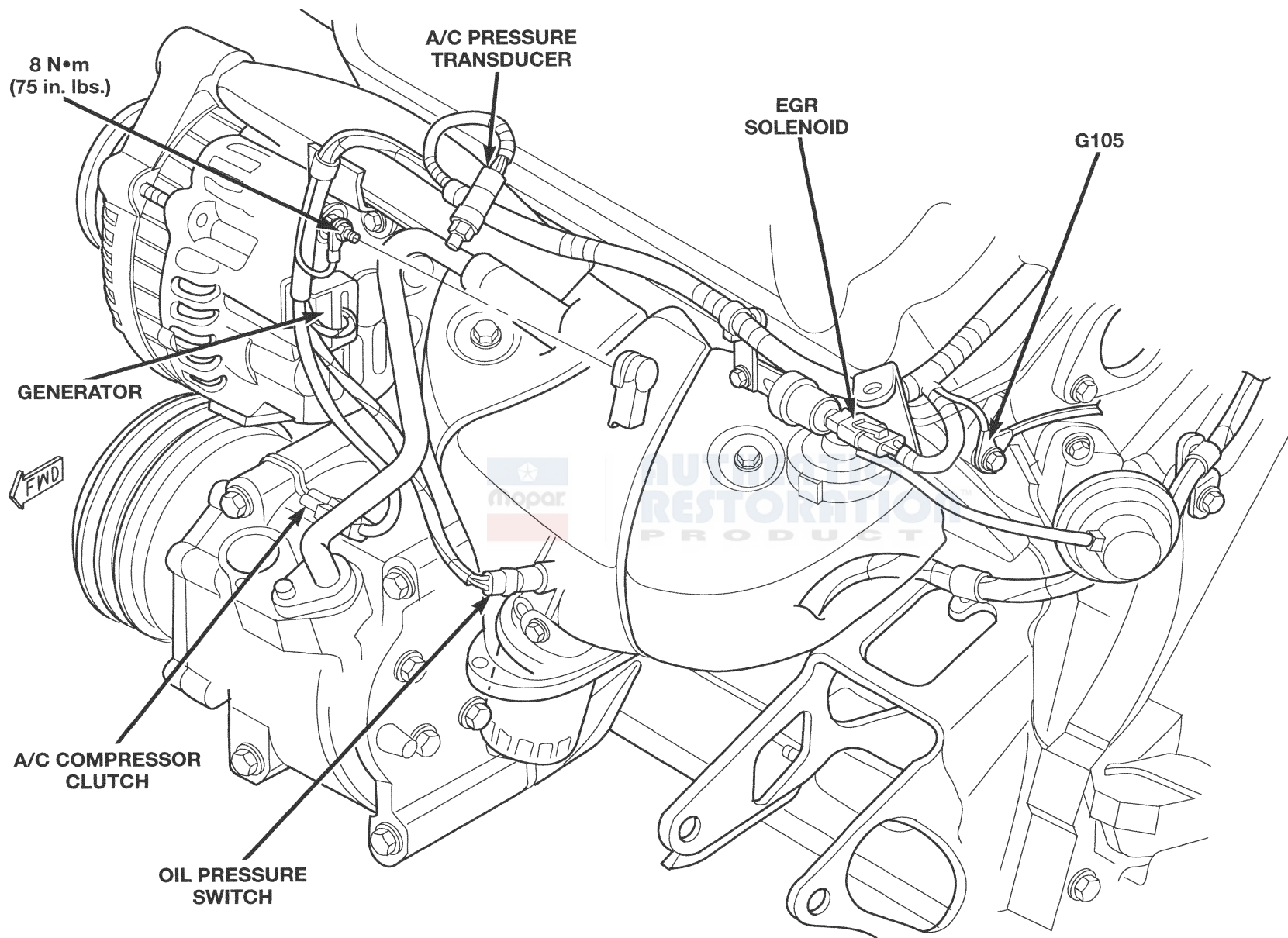
**DESCRIPTION AND OPERATION (Continued)**



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**Fig. 8 2.5L Engine Front Connectors**

**DESCRIPTION AND OPERATION (Continued)**



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**Fig. 9 2.5L Engine Generator and A/C Compressor**

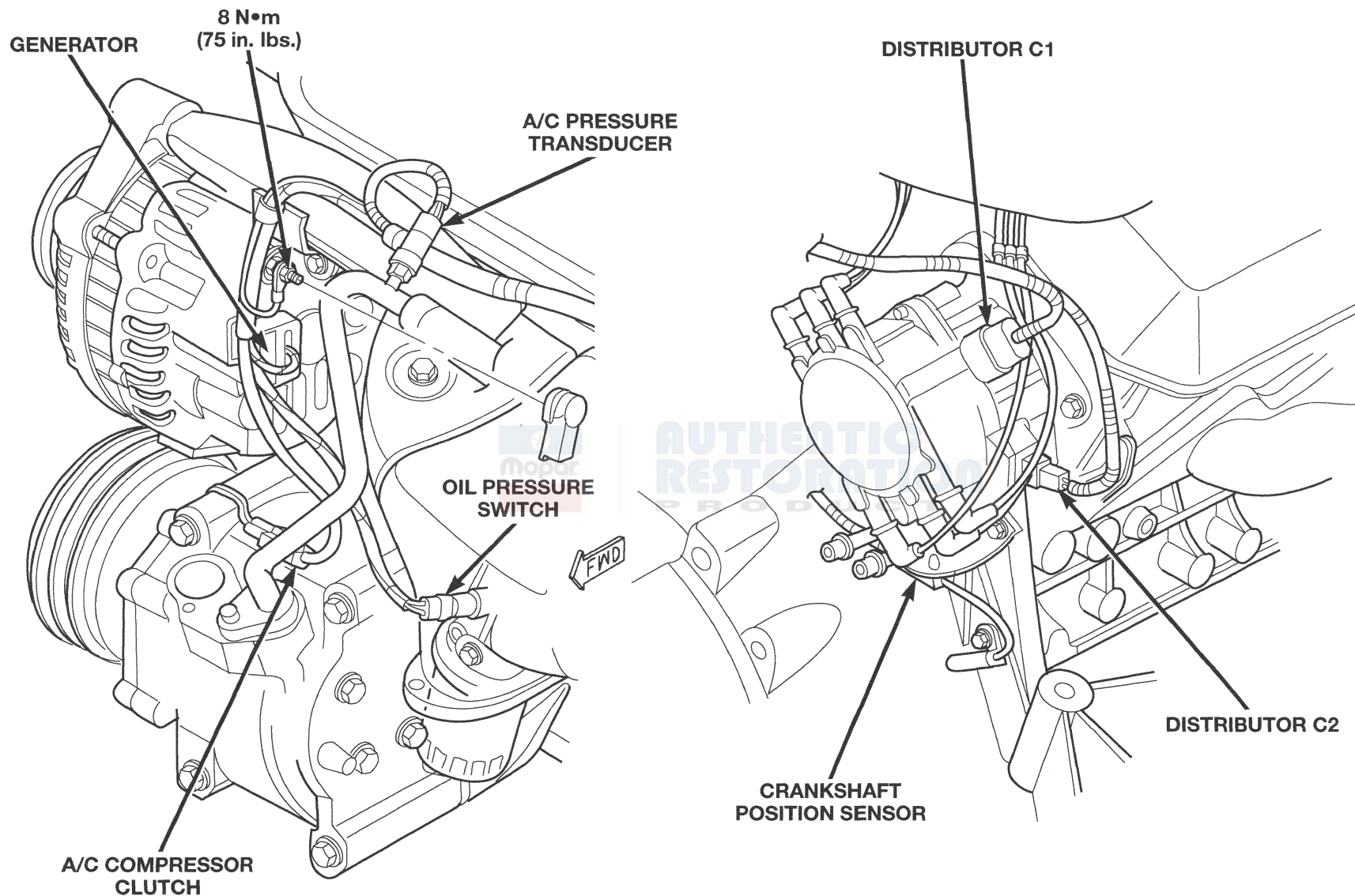
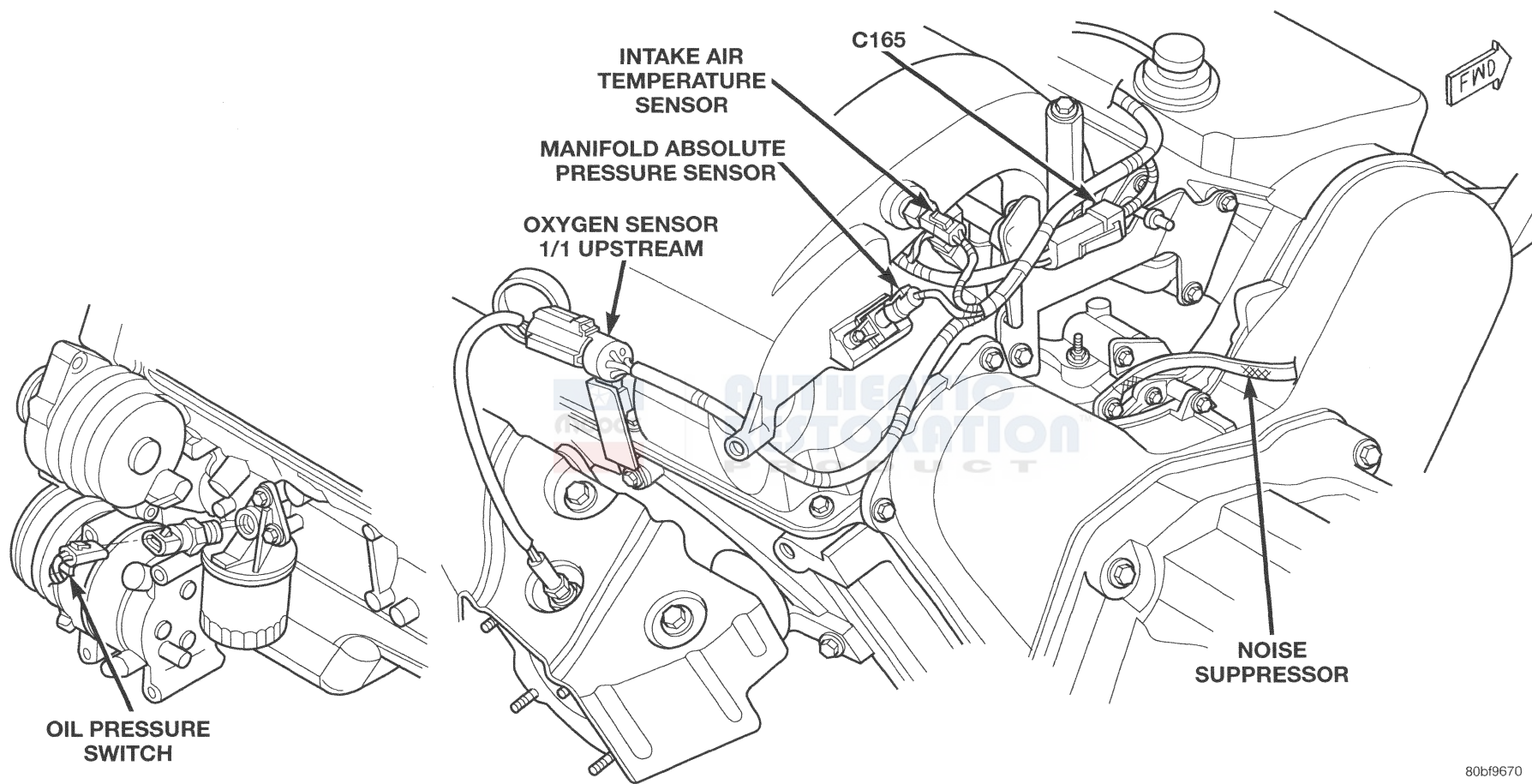


Fig. 10 2.5L Engine Distributor

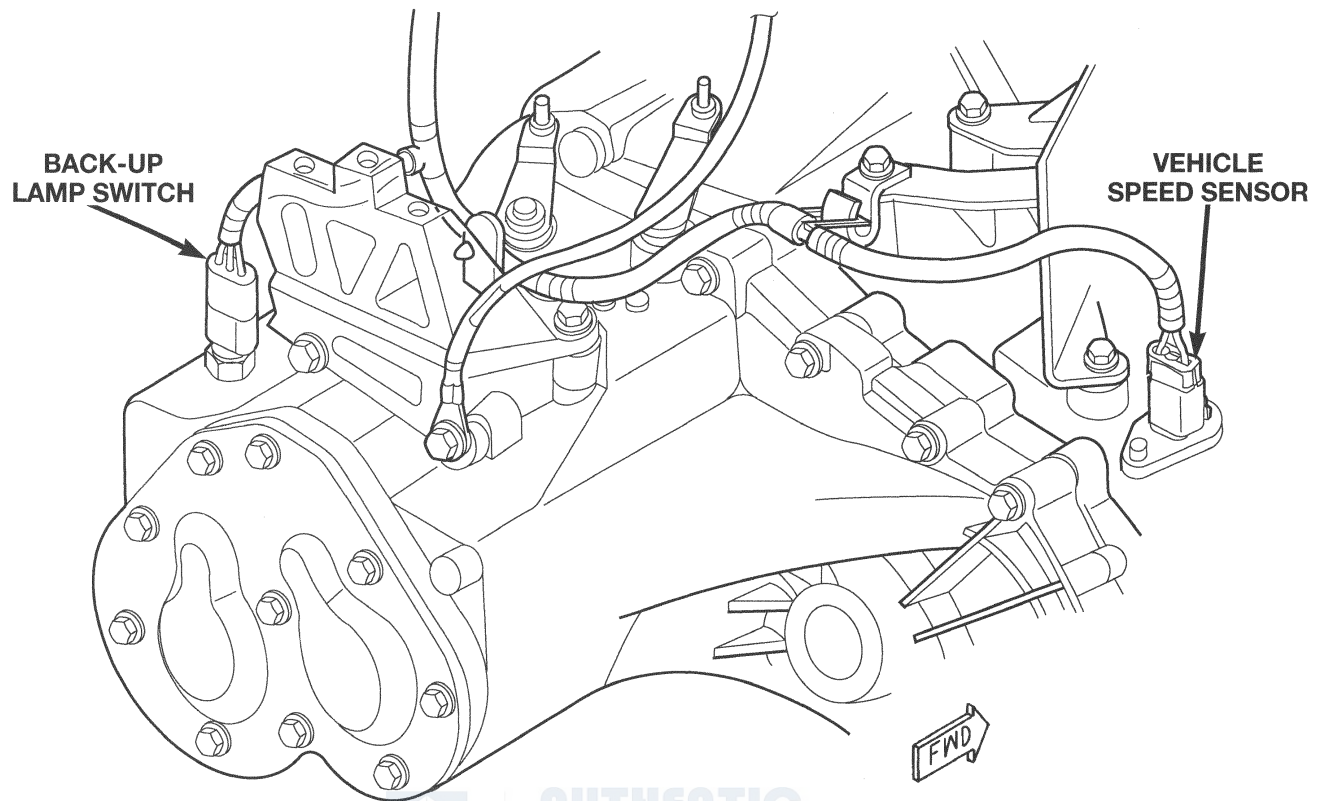
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**DESCRIPTION AND OPERATION (Continued)**

**Fig. 11 2.5L Engine Right Side**

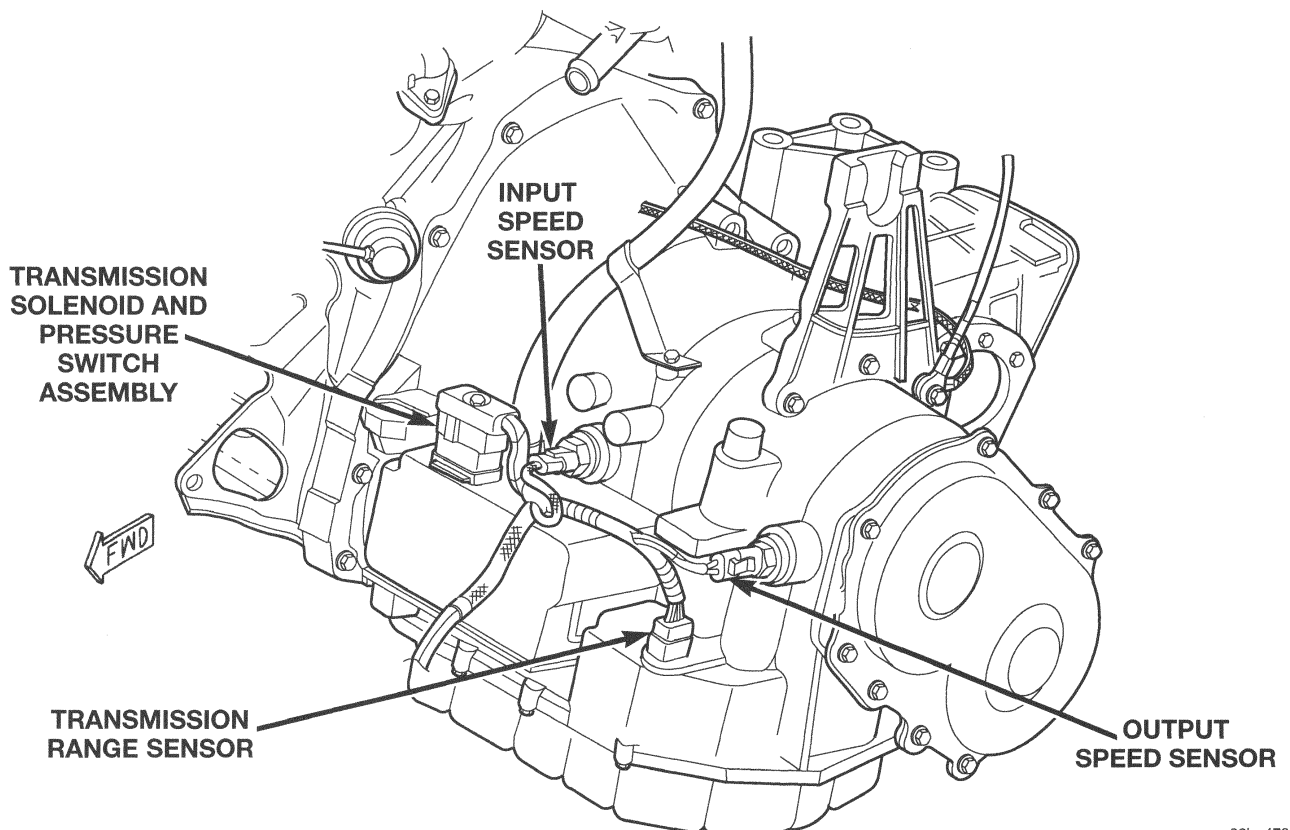


**DESCRIPTION AND OPERATION (Continued)**



**Fig. 12 Manual Transmission Connectors**

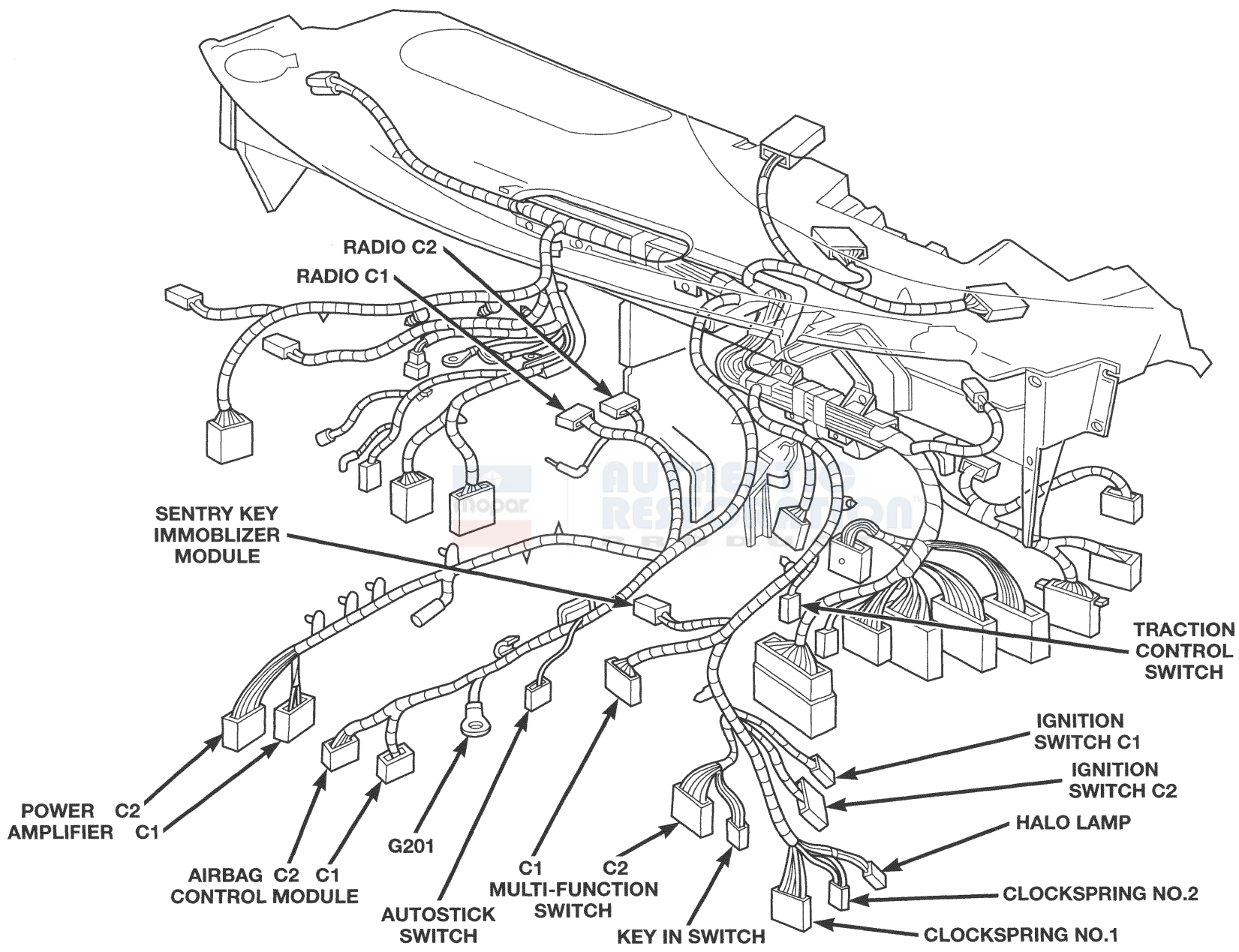
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**Fig. 13 Automatic Transmission Connectors**

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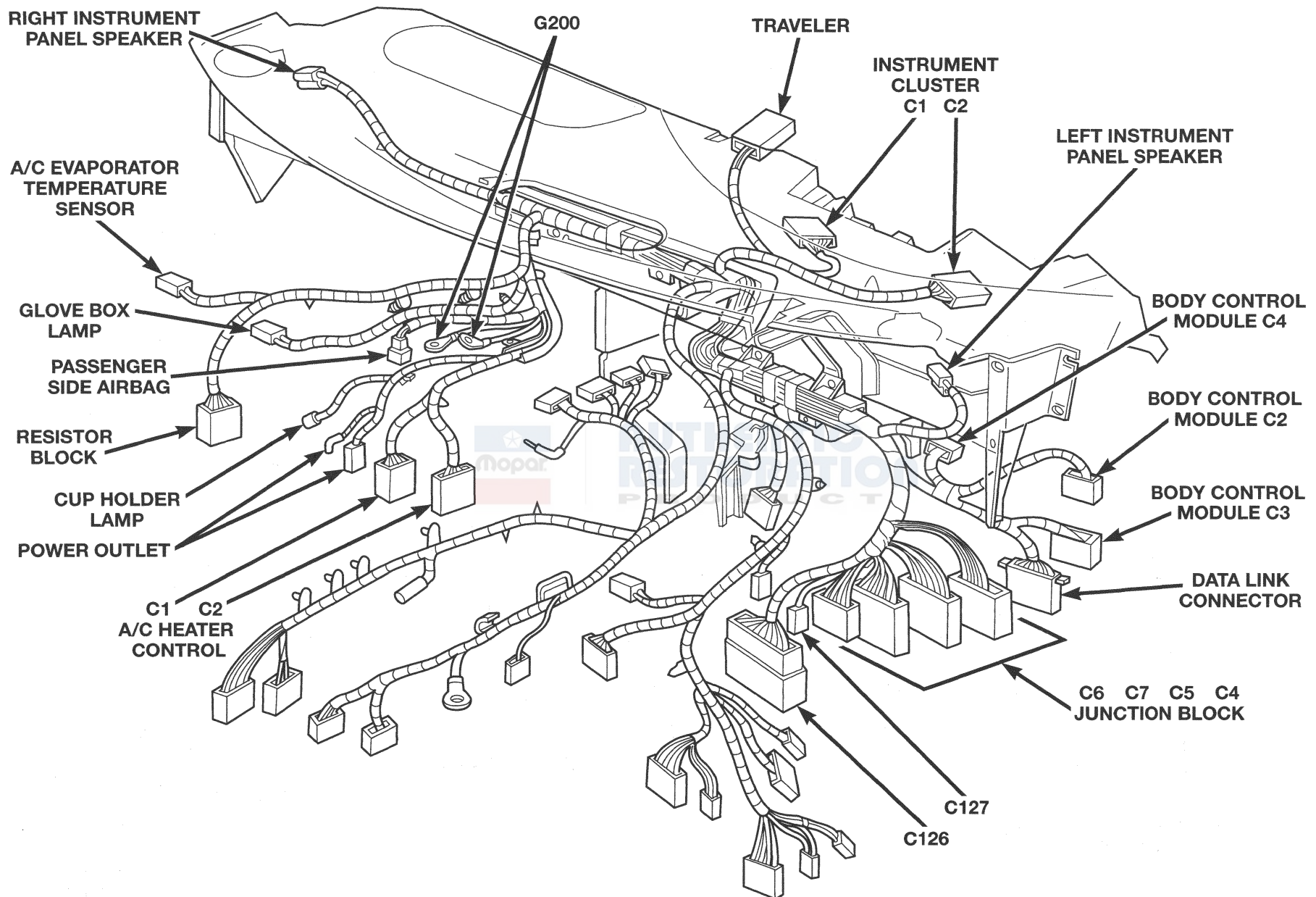
**DESCRIPTION AND OPERATION (Continued)**



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**Fig. 14 Steering Column and Console**

DESCRIPTION AND OPERATION (Continued)

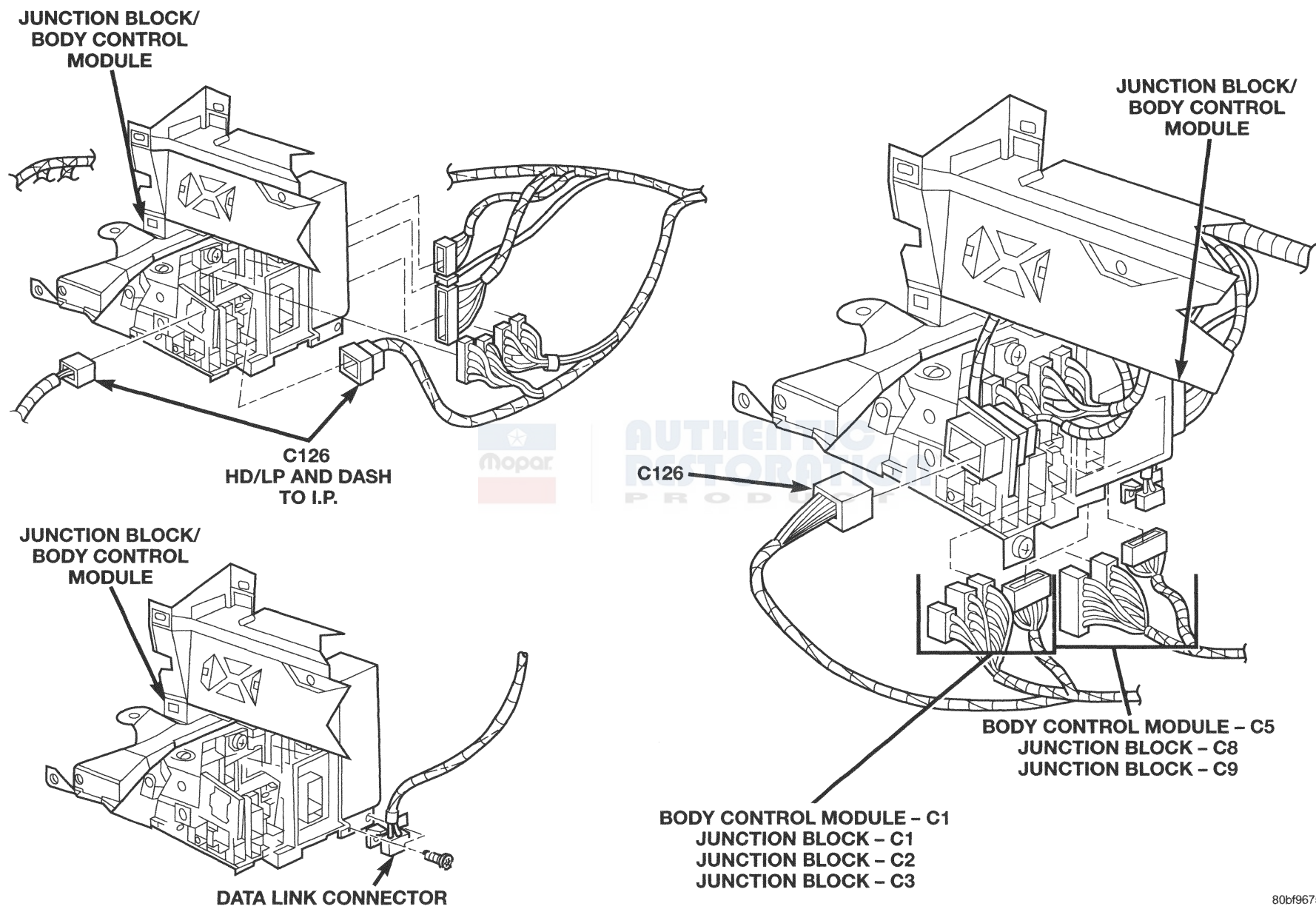


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Fig. 15 Instrument Panel Connectors



**DESCRIPTION AND OPERATION (Continued)**



**Fig. 16 Junction Block Connections**

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DESCRIPTION AND OPERATION (Continued)

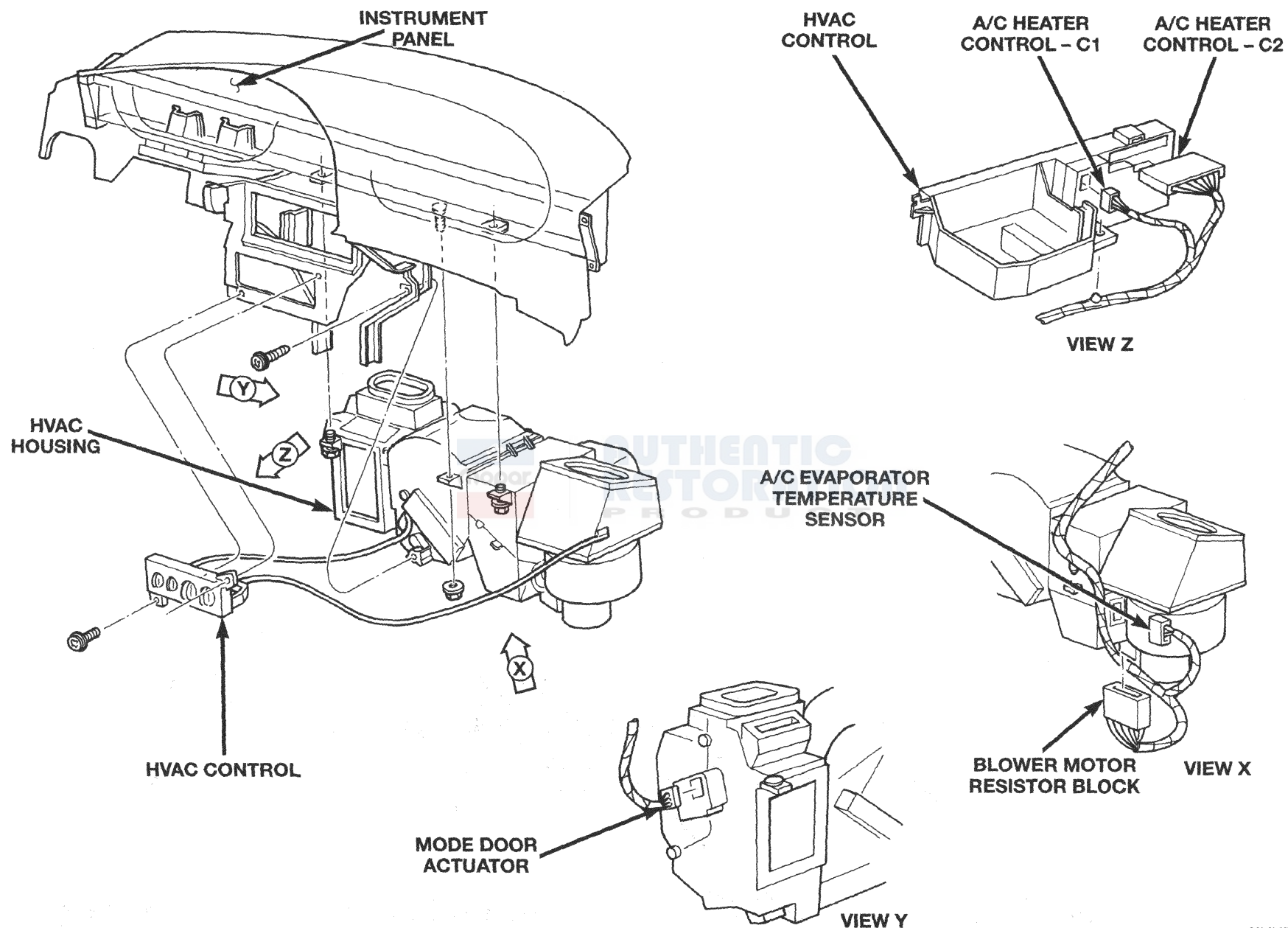
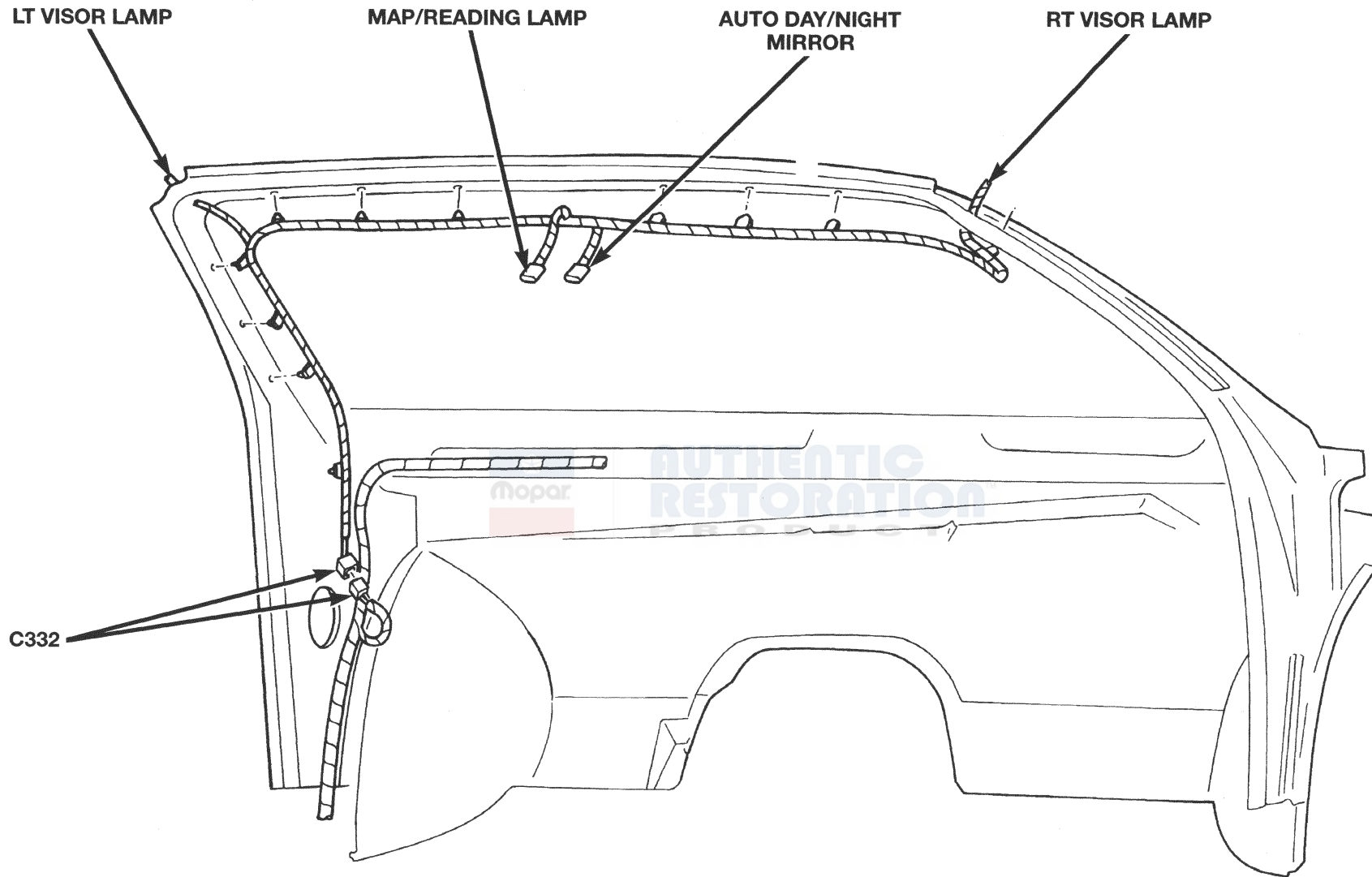


Fig. 17 HVAC Connections

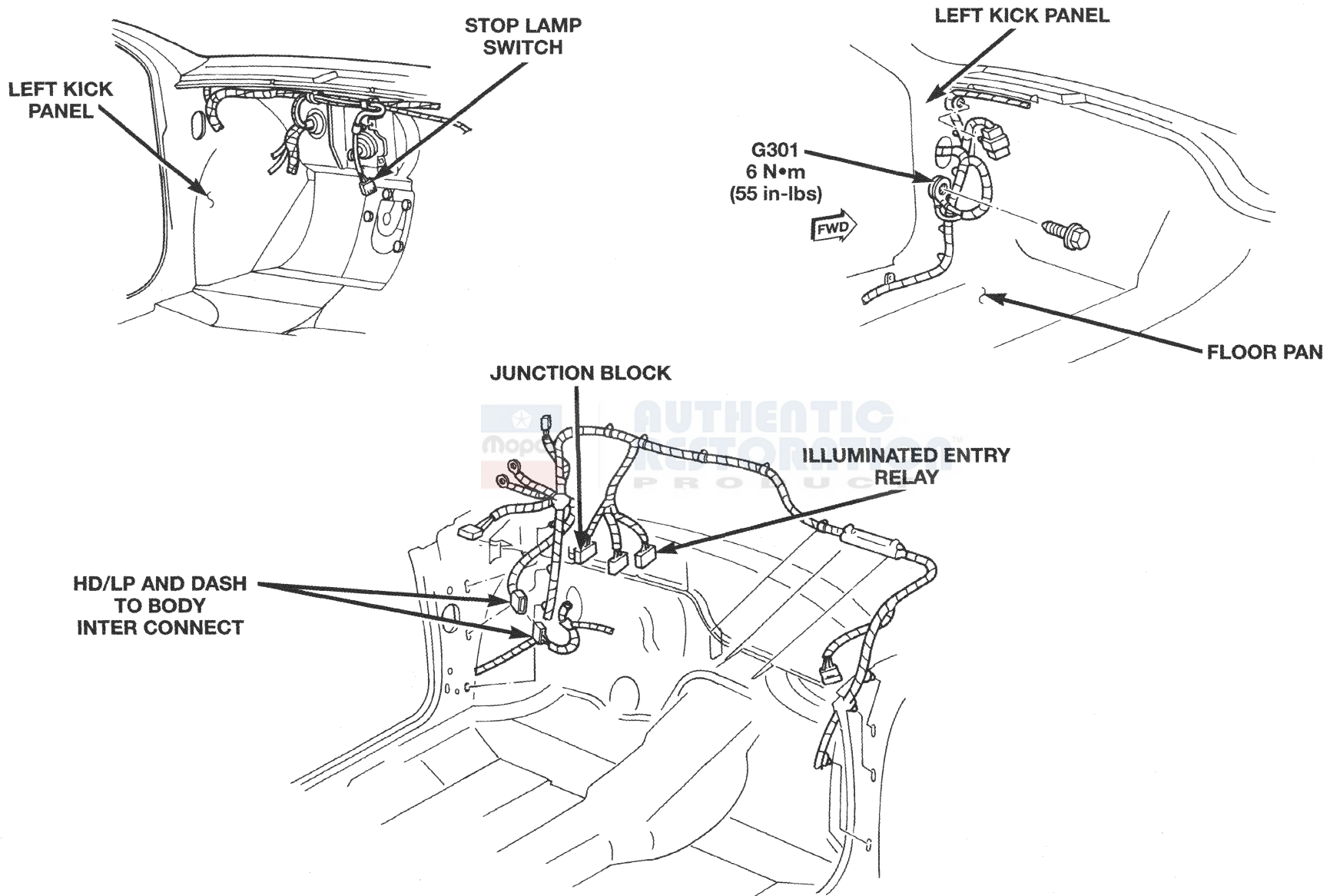
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**DESCRIPTION AND OPERATION (Continued)**



**Fig. 18 Windshield Header Connections**

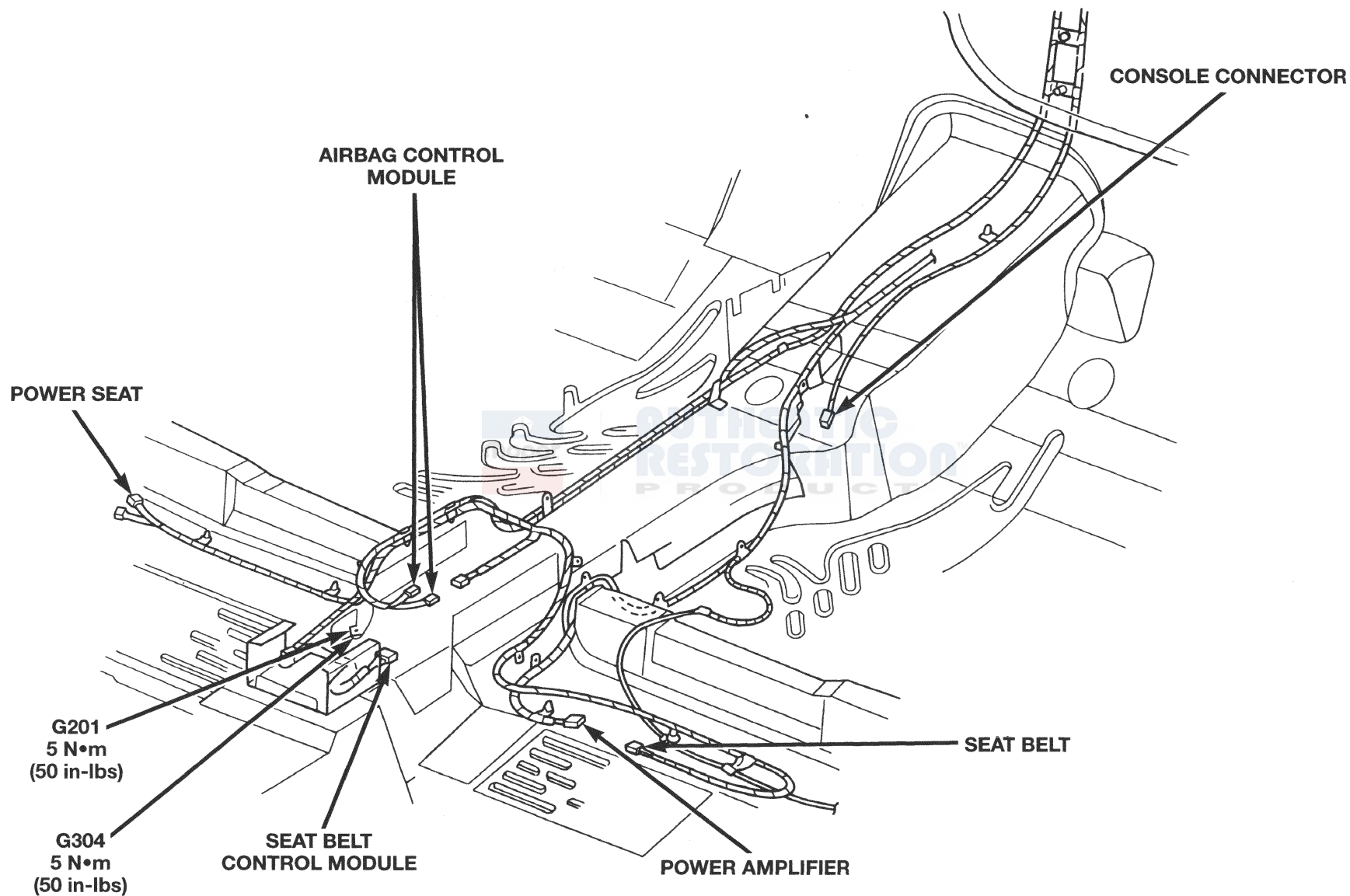
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**Fig. 19 Cowl Panel Connections**

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**DESCRIPTION AND OPERATION (Continued)**



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**Fig. 20 Console Connections**



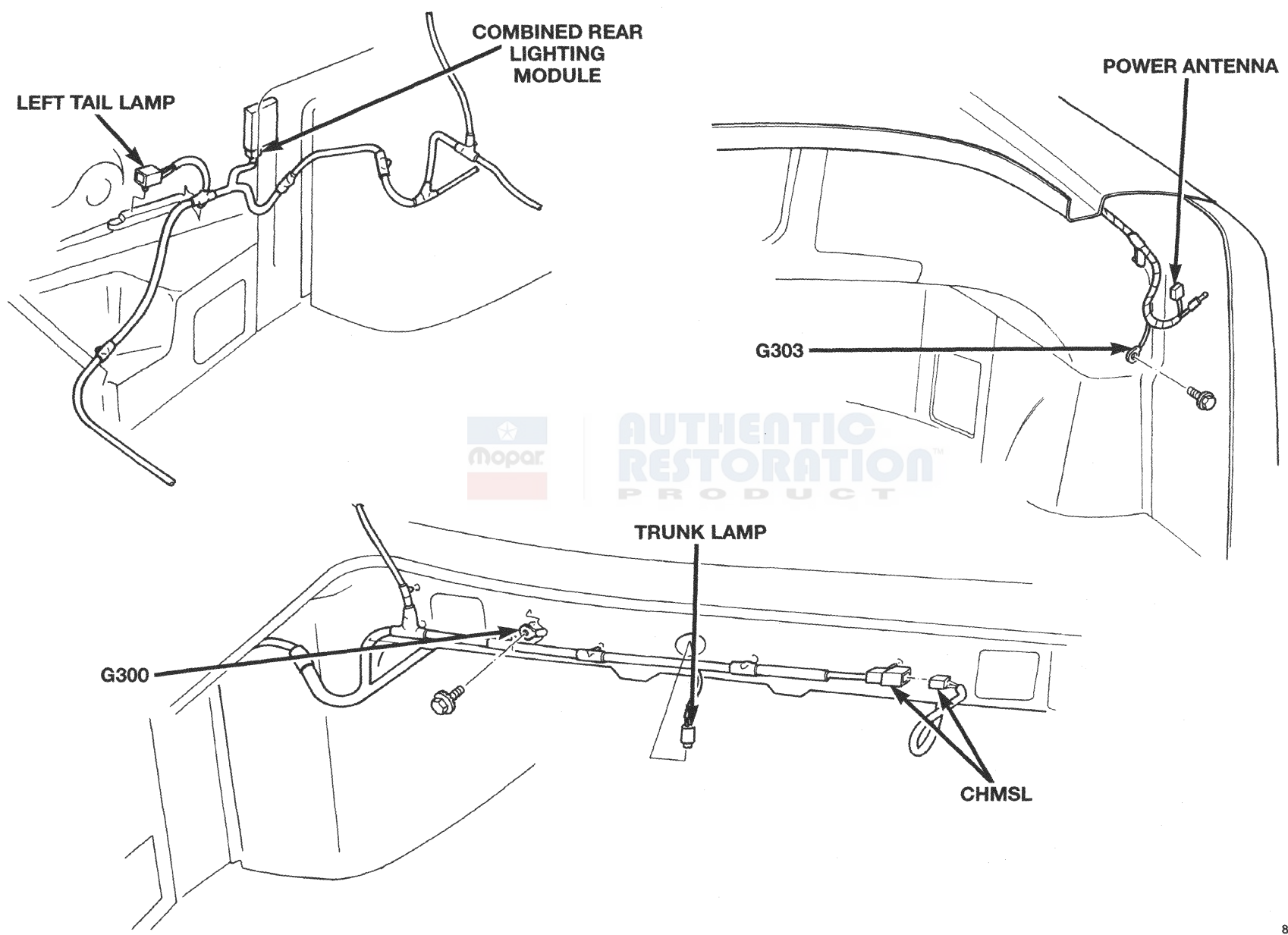
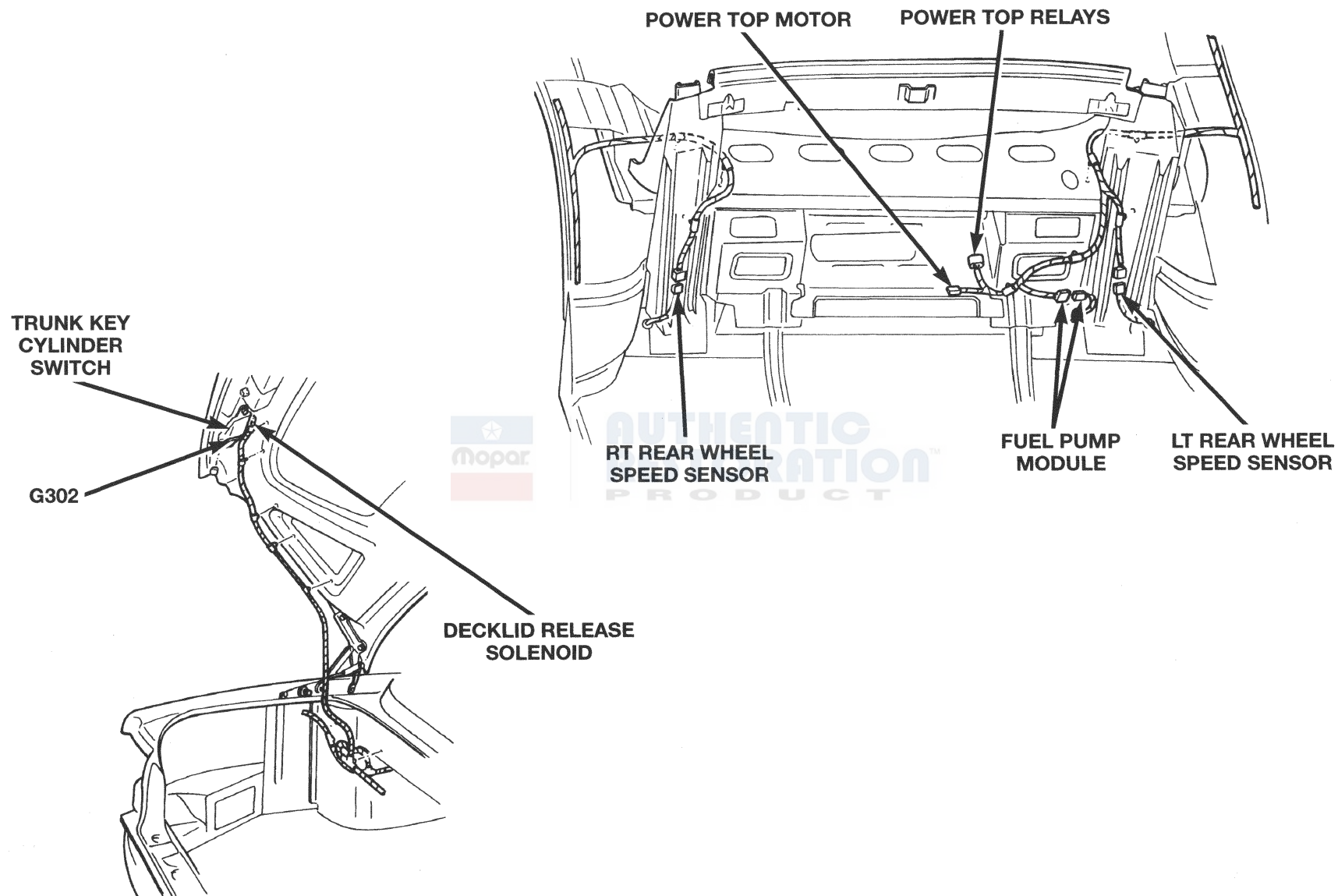


Fig. 21 Trunk Connections

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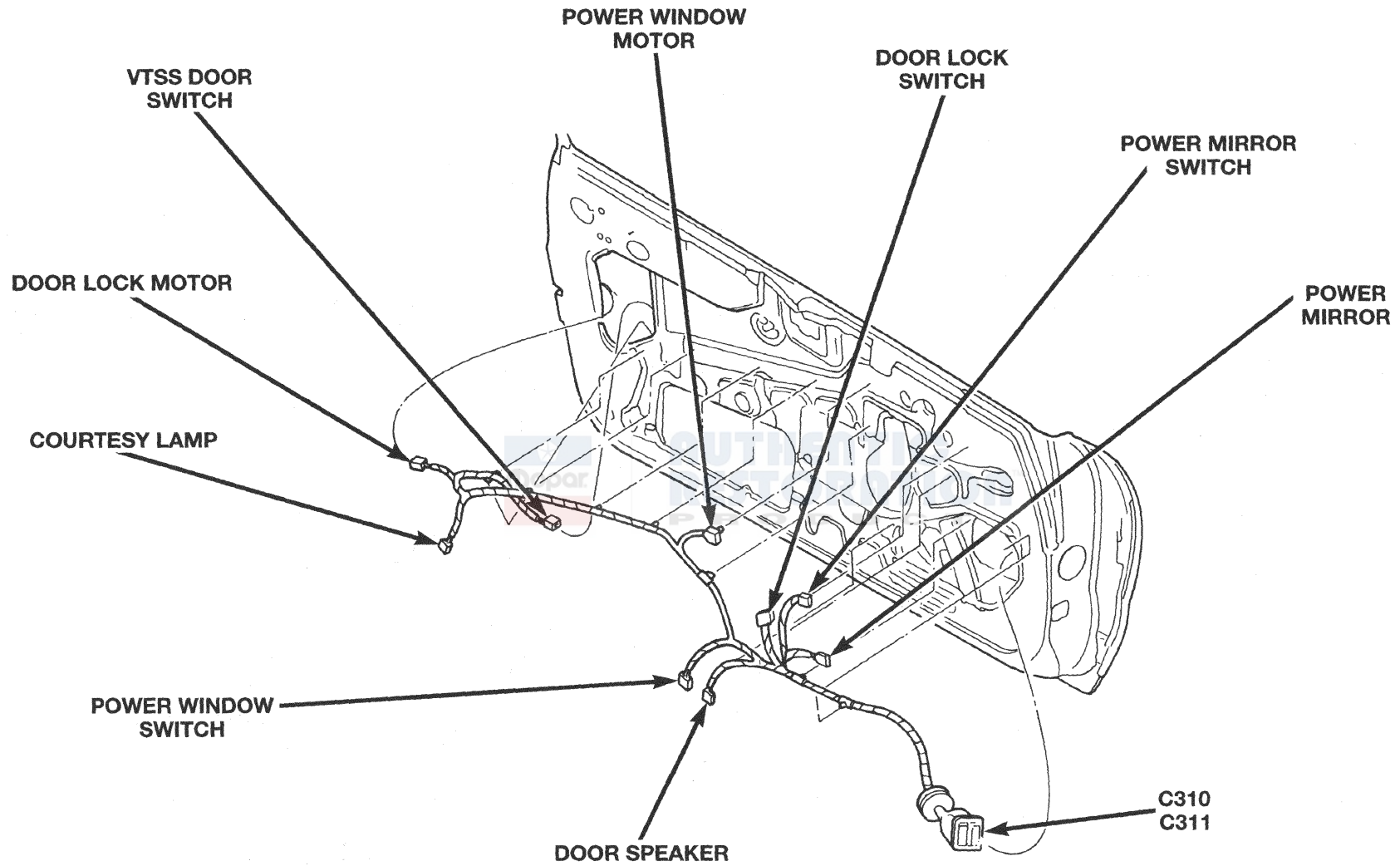
**DESCRIPTION AND OPERATION (Continued)**



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**Fig. 22 Body Connections**

**DESCRIPTION AND OPERATION (Continued)**



**Fig. 23 Door Connections (Left)**

DESCRIPTION AND OPERATION (Continued)

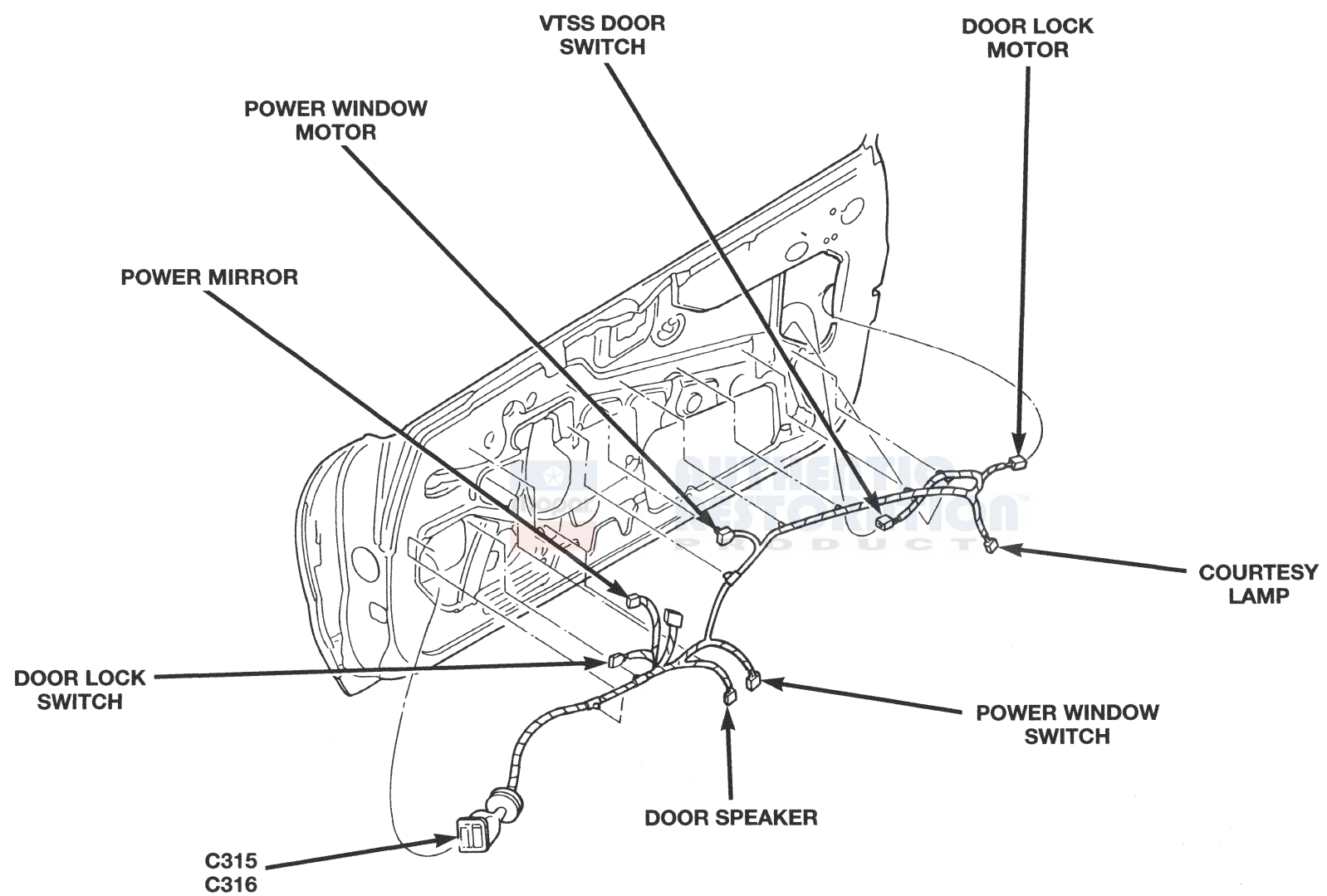


Fig. 24 Door Connections (Right)



## 8W-95 SPLICE LOCATIONS

### DESCRIPTION AND OPERATION

#### INTRODUCTION

This section provides illustrations identifying the general location of the splices in this vehicle. A splice index is provided. Use the wiring diagrams in each

section for splice number identification. Refer to the index for the proper splice number.

#### SPLICE LOCATIONS

For splices not shown in this section a N/S is placed in the Fig. column.

Splice Number	Location	Fig.
S100	In T/O for Transmission Control Module	1
S101	Left Strut Tower	1
S102	Internal to the PDC	1
S103	Internal to the PDC	1
S104	Internal to the PDC	1
S105	Internal to the PDC	1
S106	Internal to the PDC	1
S109	Left Strut Tower	1
S110	Internal to the PDC	1
S111	Right Strut Tower	2
S113	In Generator T/O	3
S114 (2.4L)	In Injector T/O	4
S114 (2.5L)	Between Inj #2 and #4	3
S115	Near EGR T/O	4
S116	Near Inj #6 T/O	3
S117	Near T/O for Cam Sensor	3, 4
S118	Near Engine Starter Motor T/O	3, 4
S120	Near T/O for PCM	3
S121	In T/O for PCM	3
S123	In No. 1,3,5 Fuel Injector Harness	N/S
S124 (2.4L)	Near T/O for Noise Suppressor	4
S124 (2.5L)	Near Distributor T/O	3
S125	Near T/O for Input Speed Sensor	5
S127	Near Powertrain Control Module C2 Connector	1
S130	Near Powertrain Control Module C2 Connector	1
S131 (2.4L)	In Ignition Coil T/O	4

Splice Number	Location	Fig.
S140	Near Brake Lamp Switch T/O	N/S
S141	Near Brake Lamp Switch T/O	N/S
S142	Internal to the PDC	1
S200	In T/O for Cigar Lighter	6
S201	Near T/O for Cluster Connectors	6
S202	Near T/O for Cluster Connectors	6
S203	Near T/O for Steering Column Connectors	6
S204	Near Steering Column T/O	6
S301	Near Near Decklid Ground	N/S
S302	Near Map/Reading Lamp T/O	7
S303	Near LT Visor Lamp T/O	7
S305	In T/O for BCM	7
S306	In T/O for BCM	7
S307	In T/O for BCM	7
S308	Driver Side Sill	N/S
S310	Near T/O for Courtesy Lamp Relay	7
S311	Near T/O for Courtesy Lamp Relay	7
S312	Left Kick Panel	7
S313	Near Center High Mounted Stop Lamp	N/S
S400	Near Right Door Connector	8
S401	Near Right Door Speaker T/O	8
S402	Near Left Door Connector	8
S403	Near Right Door Connector	8
S404	Near Back Up Lamp T/O	N/S
S405	Near Right Tail Lamps	N/S

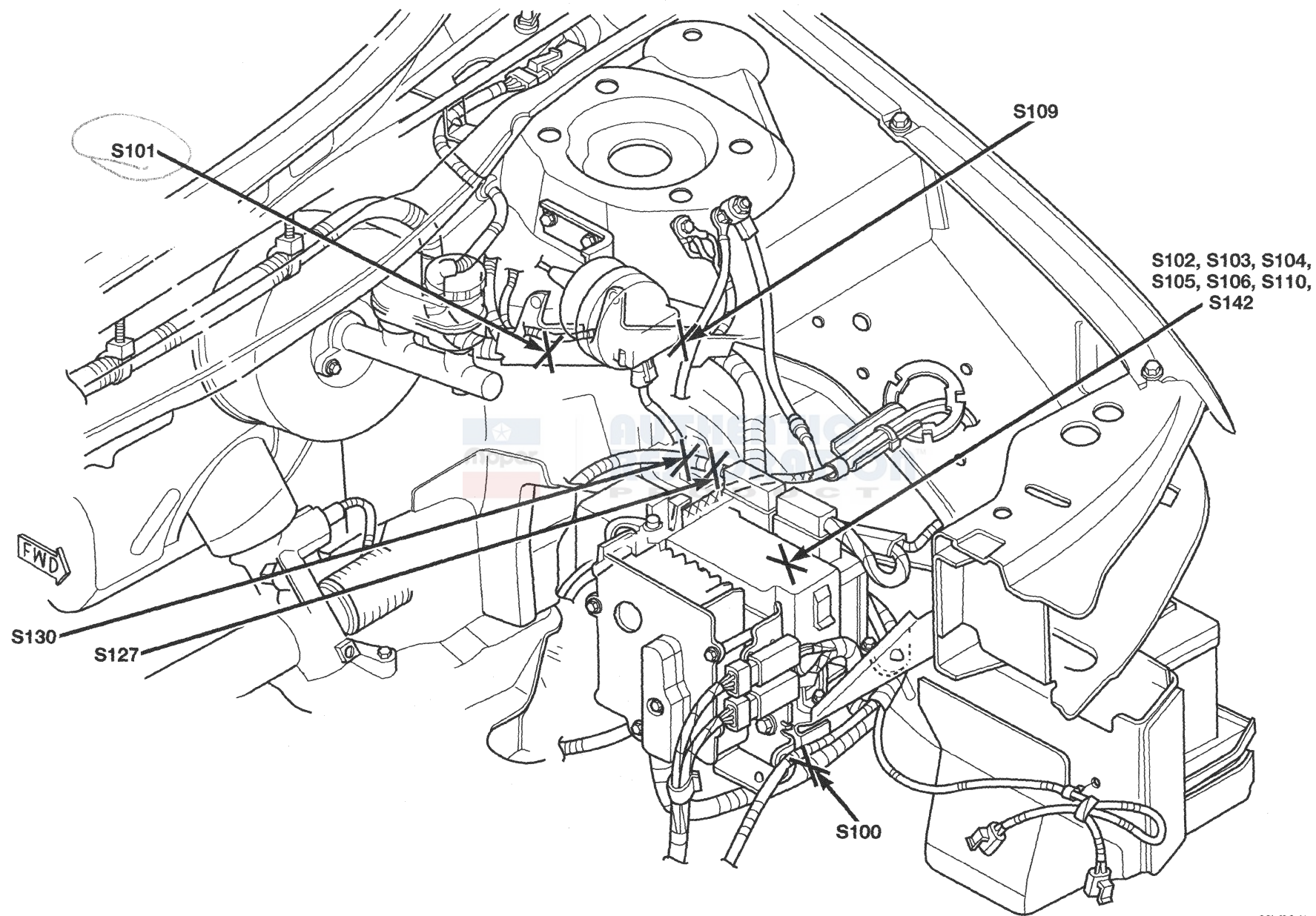
**DESCRIPTION AND OPERATION (Continued)**

Splice Number	Location	Fig.	Splice Number	Location	Fig.
S406	In Tail Lamp	N/S	S410	Near Left Door Speaker T/O	8
S407	In Tail Lamp	N/S			



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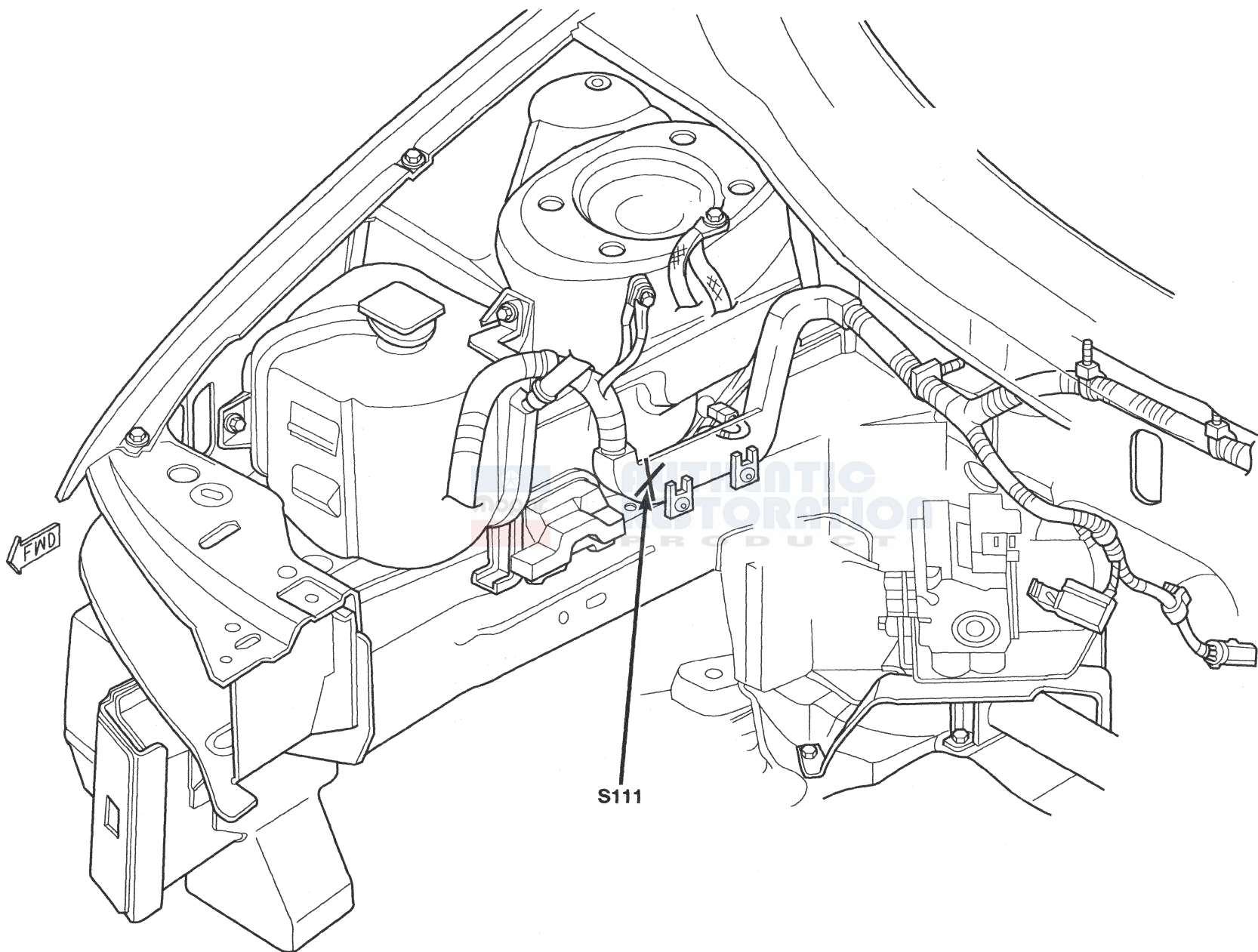
**DESCRIPTION AND OPERATION (Continued)**



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**Fig. 1 Engine Compartment Splices Left Side**

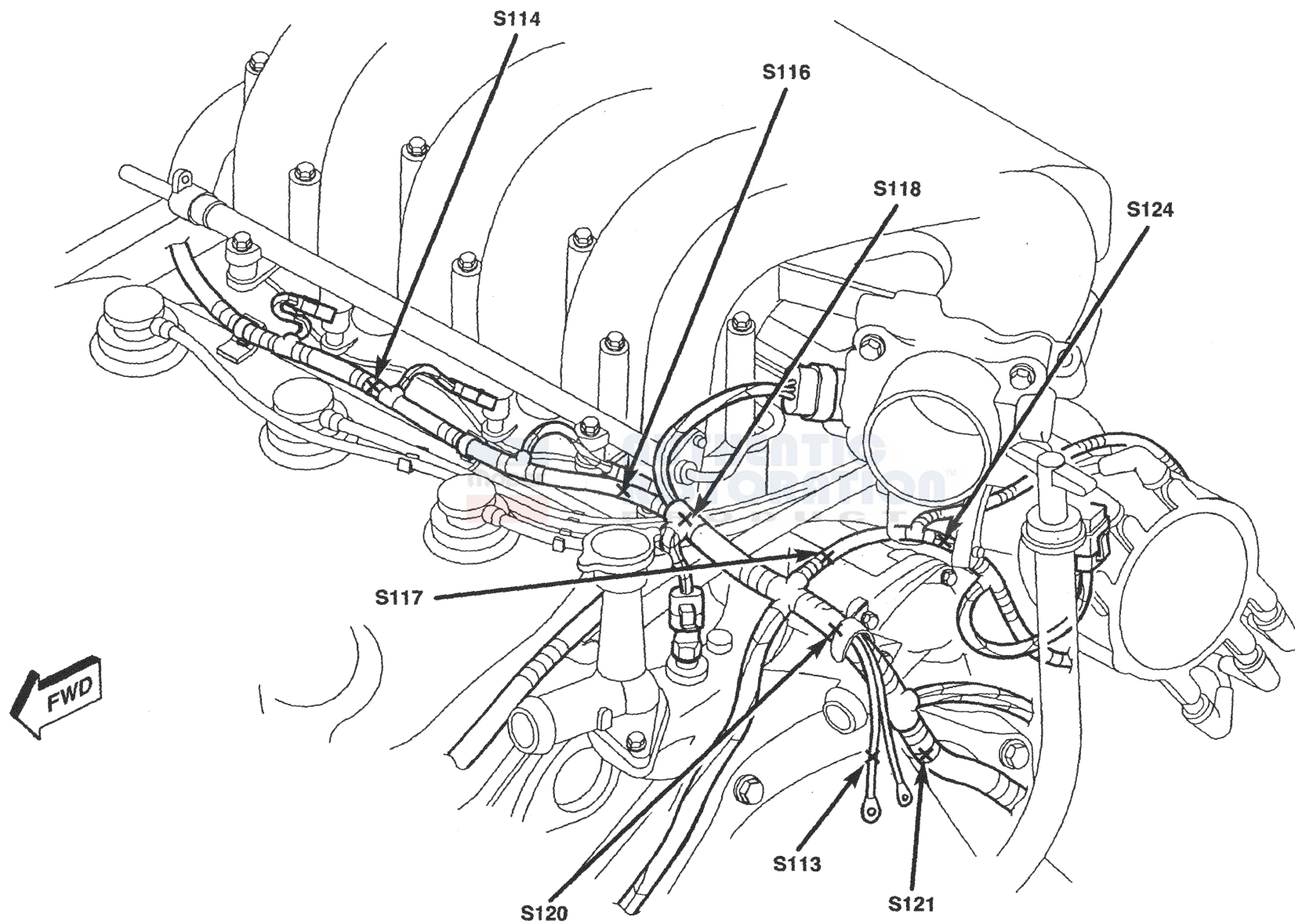
**DESCRIPTION AND OPERATION (Continued)**



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**Fig. 2 Engine Compartment Splices Right Side**

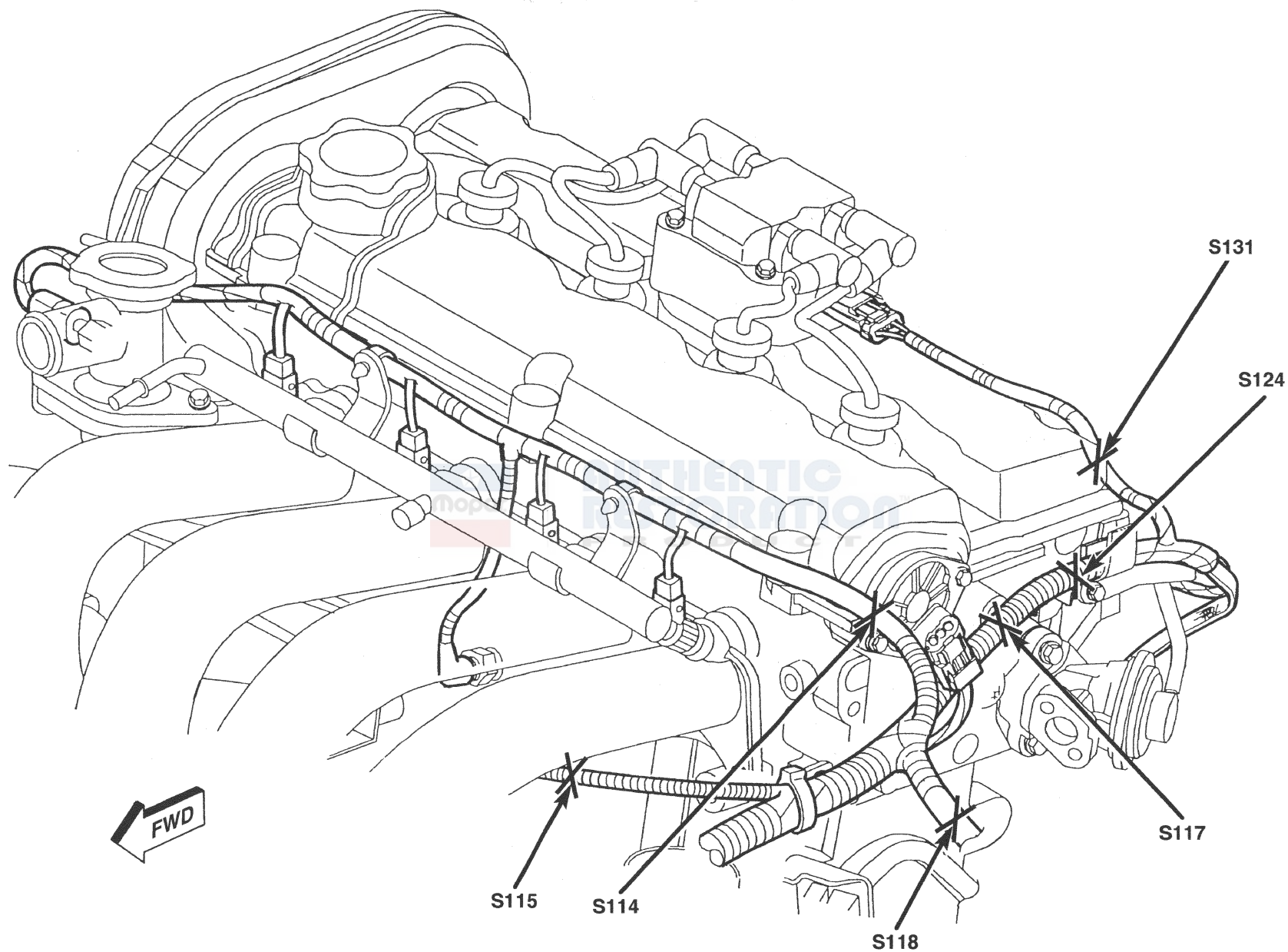




**Fig. 3 Engine Harness Splices 2.5L Engine**

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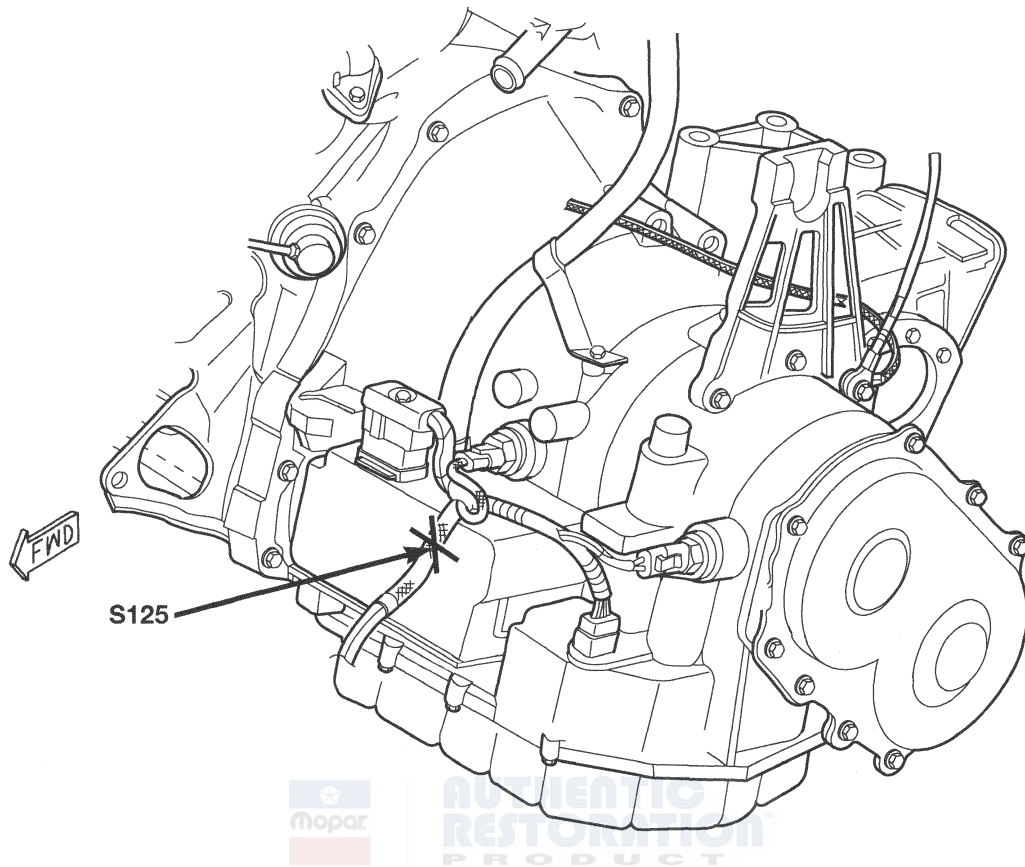
## DESCRIPTION AND OPERATION (Continued)



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Fig. 4 Engine Harness Splices 2.4L Engine

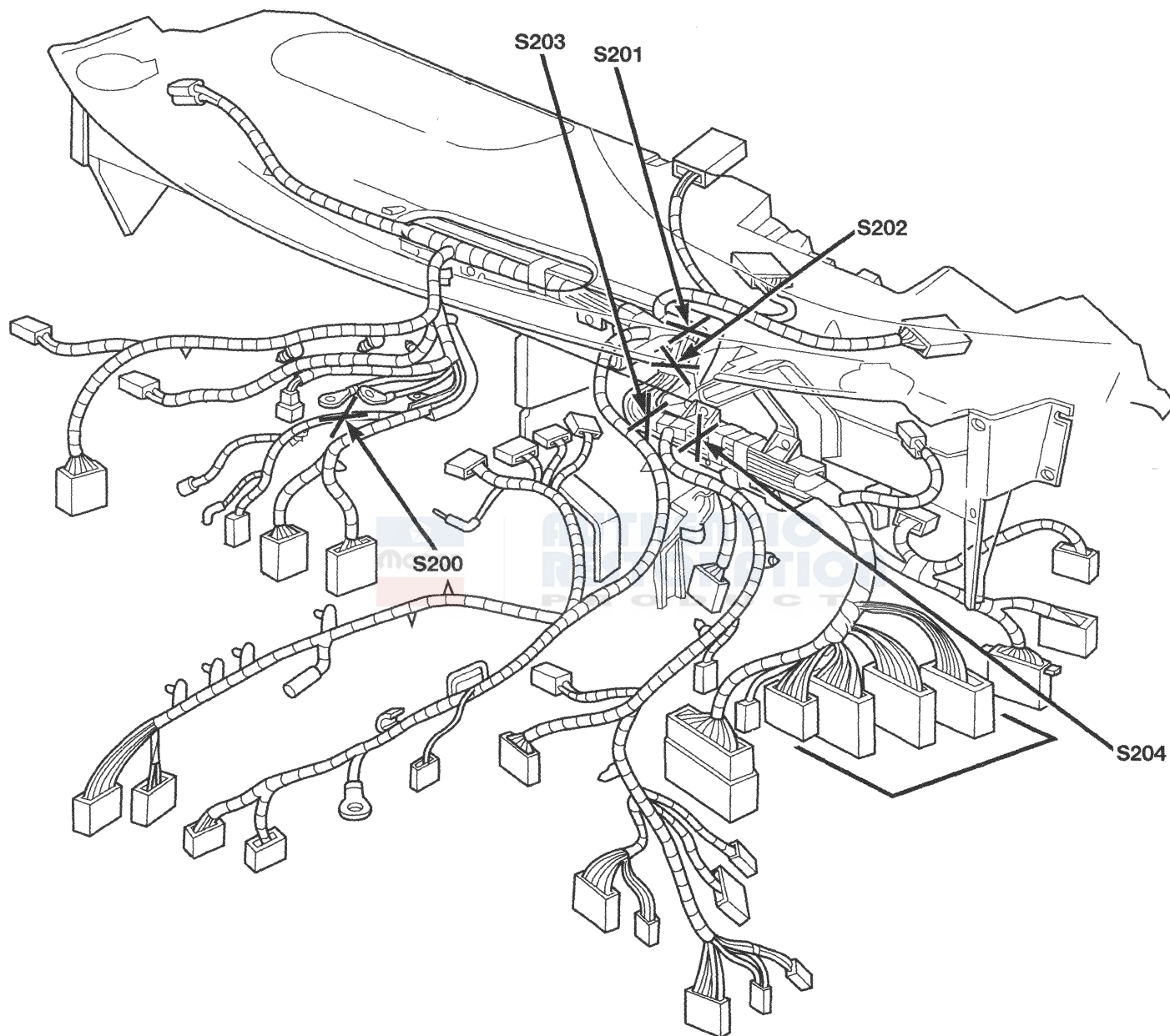
**DESCRIPTION AND OPERATION (Continued)**



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**Fig. 5 Transmission Harness Splices**

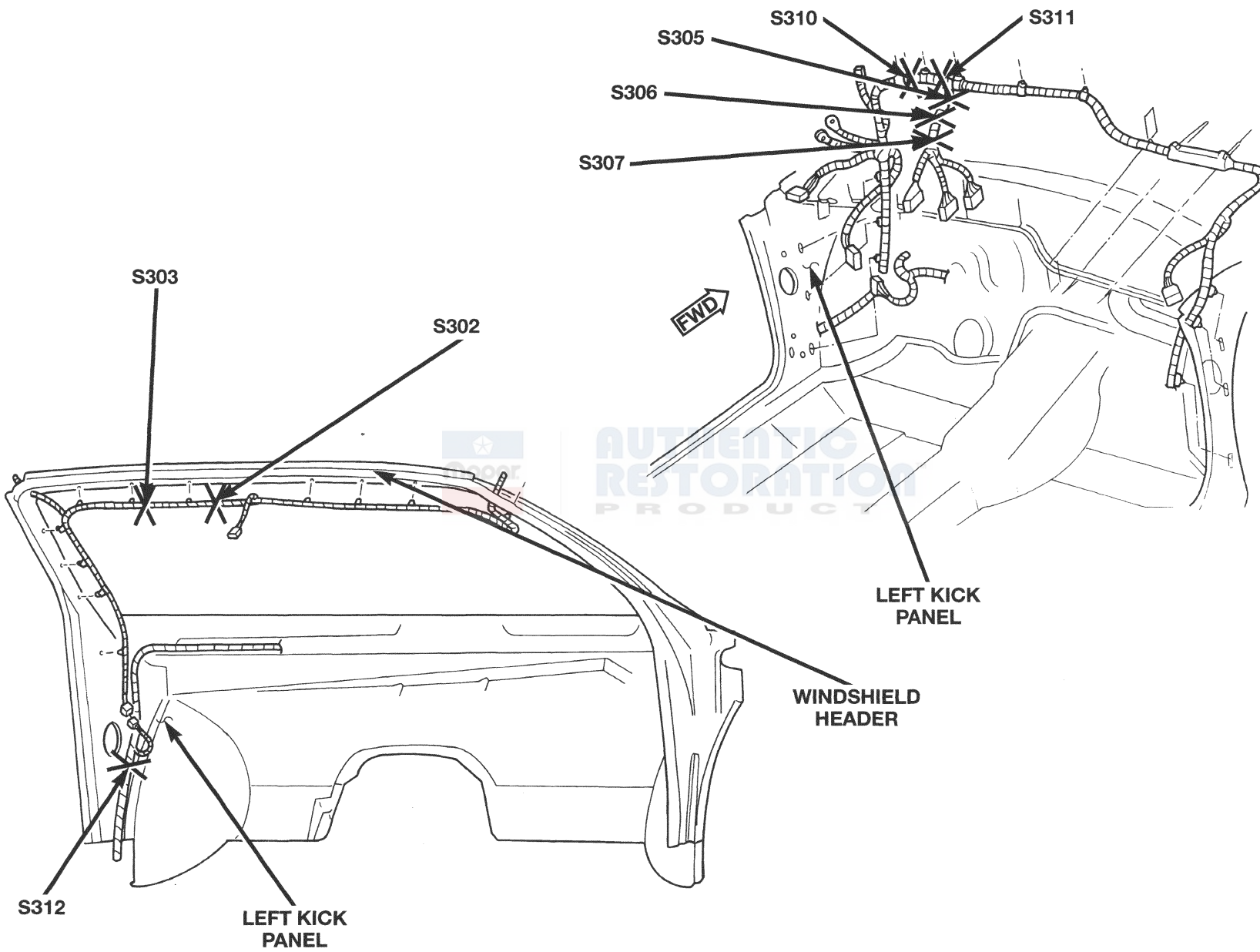
**DESCRIPTION AND OPERATION (Continued)**



**Fig. 6 Instrument Panel Splices**

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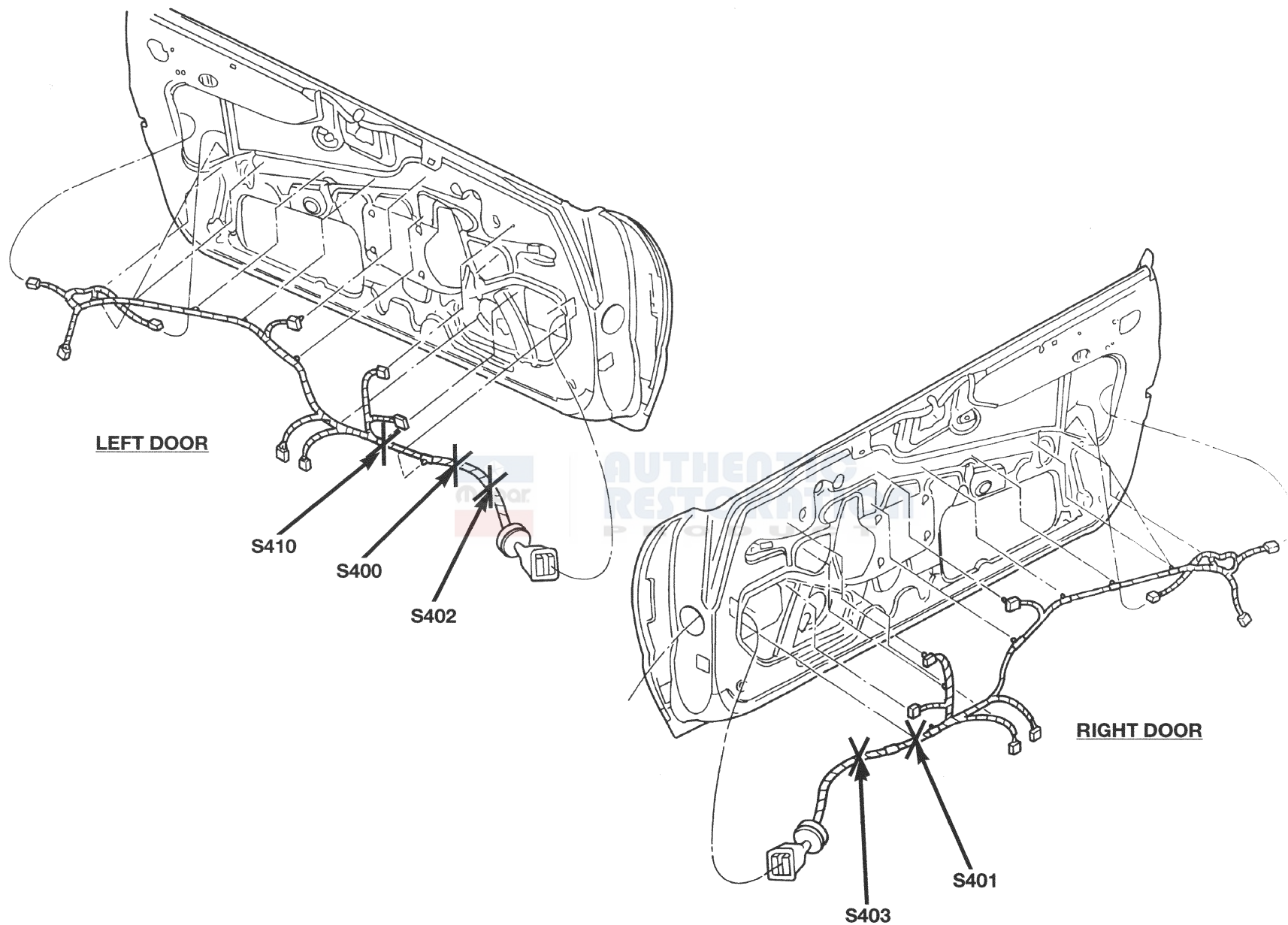




**Fig. 7 Body Harness**

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**DESCRIPTION AND OPERATION (Continued)**



**Fig. 8 Door Harness Splices**

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# ENGINE

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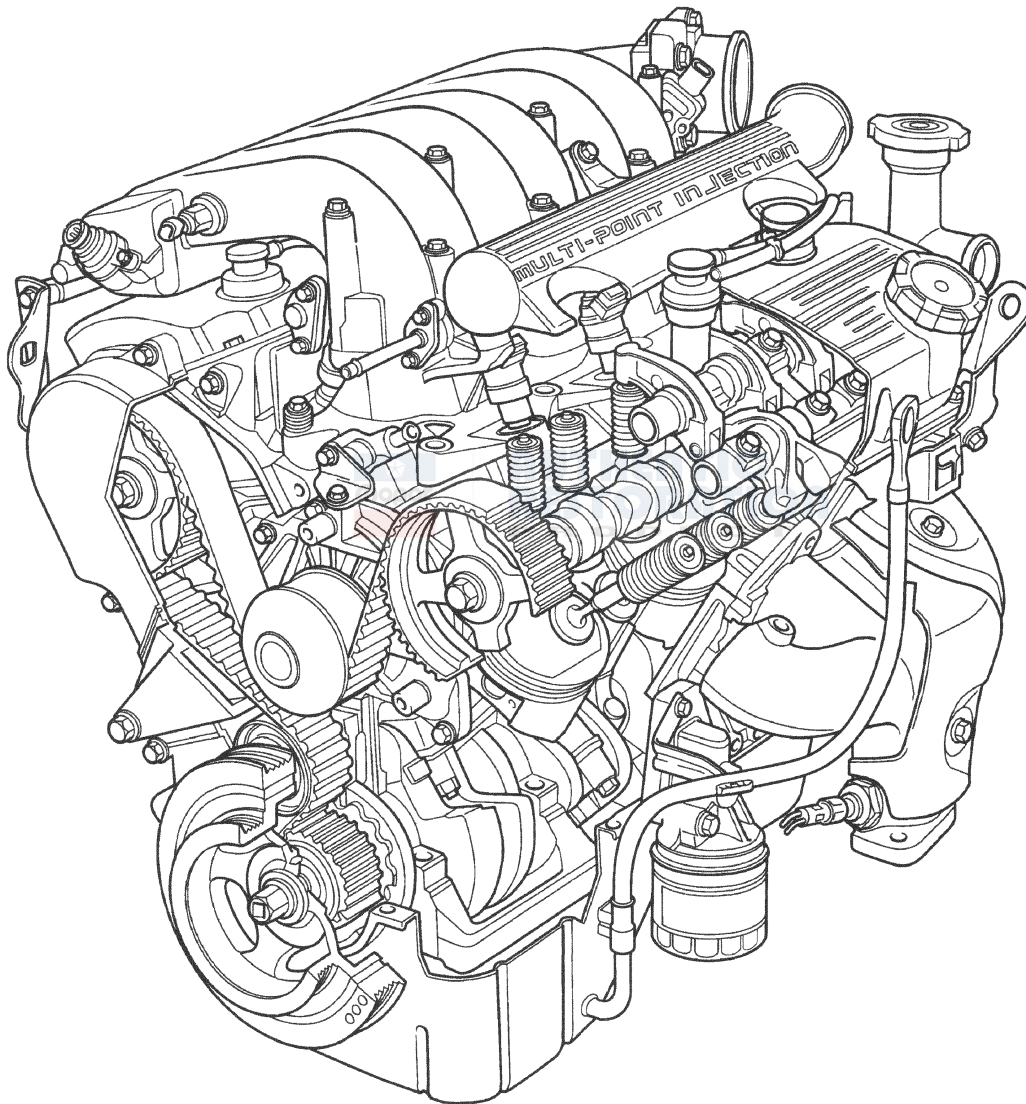
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## DESCRIPTION AND OPERATION

### 2.5L ENGINE



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**Fig. 1 2.5L V-6 Engine**

### DESCRIPTION

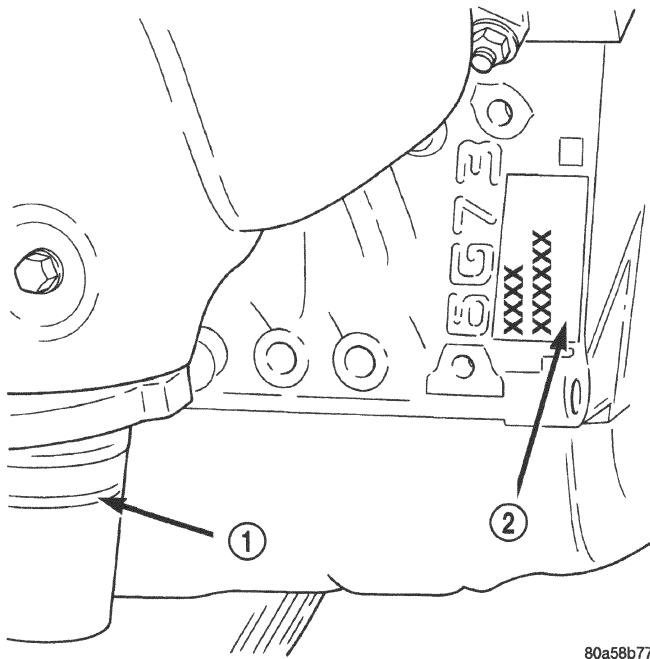
The 2.5 Liter (152 cu. in.) 60° V-6 engine is a single overhead camshaft (per bank) with four valves per cylinder design (Fig. 1). The engine does not have provisions for a free wheeling valve train.

The firing order is 1-2-3-4-5-6. The cylinders are numbered from the front of the engine to the rear.

The front cylinder bank is numbered 2, 4, and 6. The rear cylinder bank is numbered 1, 3, and 5.

The engine identification number is located on the rear of the cylinder block just below the cylinder head (Fig. 2).



**DESCRIPTION AND OPERATION (Continued)****Fig. 2 Engine Identification**

- 1 - OIL FILTER  
2 - ENGINE SERIAL NUMBER AND VIN NUMBER

**CYLINDER BLOCK****DESCRIPTION**

The cast iron cylinder block is a partial open design to improve cooling and weight reduction (Fig. 3). High rigidity is provided with ribs cast in the outer wall, and a monoblock or beam type main bearing cap system. This single unit four bearing main cap is designed to control vibration of the cylinder block partition walls.

**CRANKSHAFT****DESCRIPTION**

The crankshaft is made of nodular cast iron and has six individual throws with five counter weights (Fig. 3). The crankshaft is supported by four main bearings

with number three being the thrust bearing. The six separate connecting rod throws pins reduce torque fluctuations while a dynamic damper is used to control torsional vibration of the crankshaft. Rubber lipped seals are used at front and rear. The front seal is retained in the oil pump case and the rear is retained in a die-cast aluminum block-mounted housing.

**PISTONS AND CONNECTING RODS****DESCRIPTION**

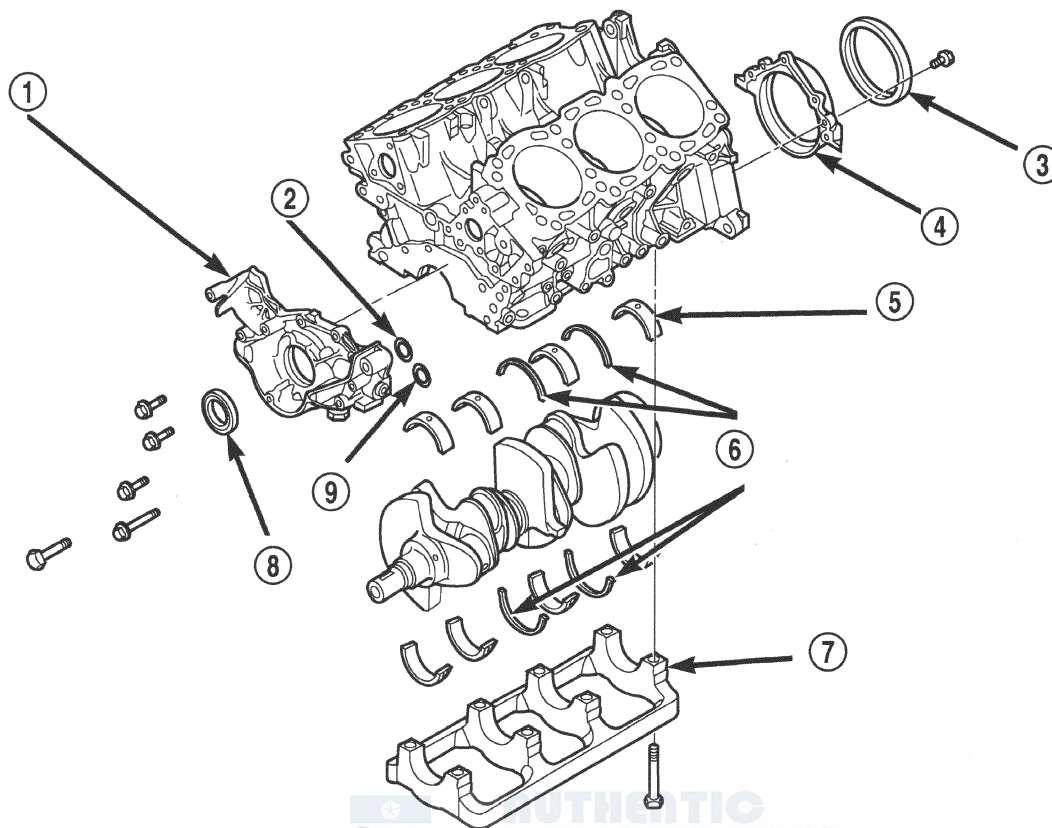
The pistons are made of aluminum alloy with cast-in steel struts at the pin bosses for autothermic control. The piston rings consist of a chrome-plated, barrel faced design for the top ring, the second ring is a cast iron tapered face design and the oil ring is a chrome faced three piece design. Piston pins are press-fitted into place, to join the pistons to the forged steel connecting rods. The large end of the connecting rod has a oil jet hole for lubrication of the thrust side of the cylinder.

**CYLINDER HEAD****DESCRIPTION**

The aluminum alloy cylinder heads feature a pent-roof design with four valves per cylinder (Fig. 4). Valve guides are made of cast iron alloy and seat inserts are made of sintered alloy iron, these are pressed into the head. To improve combustion efficiency the chambers have a compact pent-roof design with a squish area. The cylinder heads are common to either cylinder bank.

**OPERATION**

The cylinder head closes the combustion chamber, allowing the pistons to compress the air/fuel mixture for ignition. The valves are actuated by the lobe profiles on the camshaft to open and close at specified duration to either allow clean air in the combustion chamber or the exhaust gases out; depending on the stroke of the engine.

**DESCRIPTION AND OPERATION (Continued)****Fig. 3 Cylinder Block and Crankshaft**

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- 1 - OIL PUMP ASSEMBLY
- 2 - O-RING
- 3 - SEAL
- 4 - CASE
- 5 - UPPER BEARING (GROOVED)

- 6 - THRUST BEARINGS (2 PAIRS)
- 7 - MAIN BEARING MONOBLOCK CAP
- 8 - SEAL
- 9 - O-RING

**CAMSHAFT****DESCRIPTION**

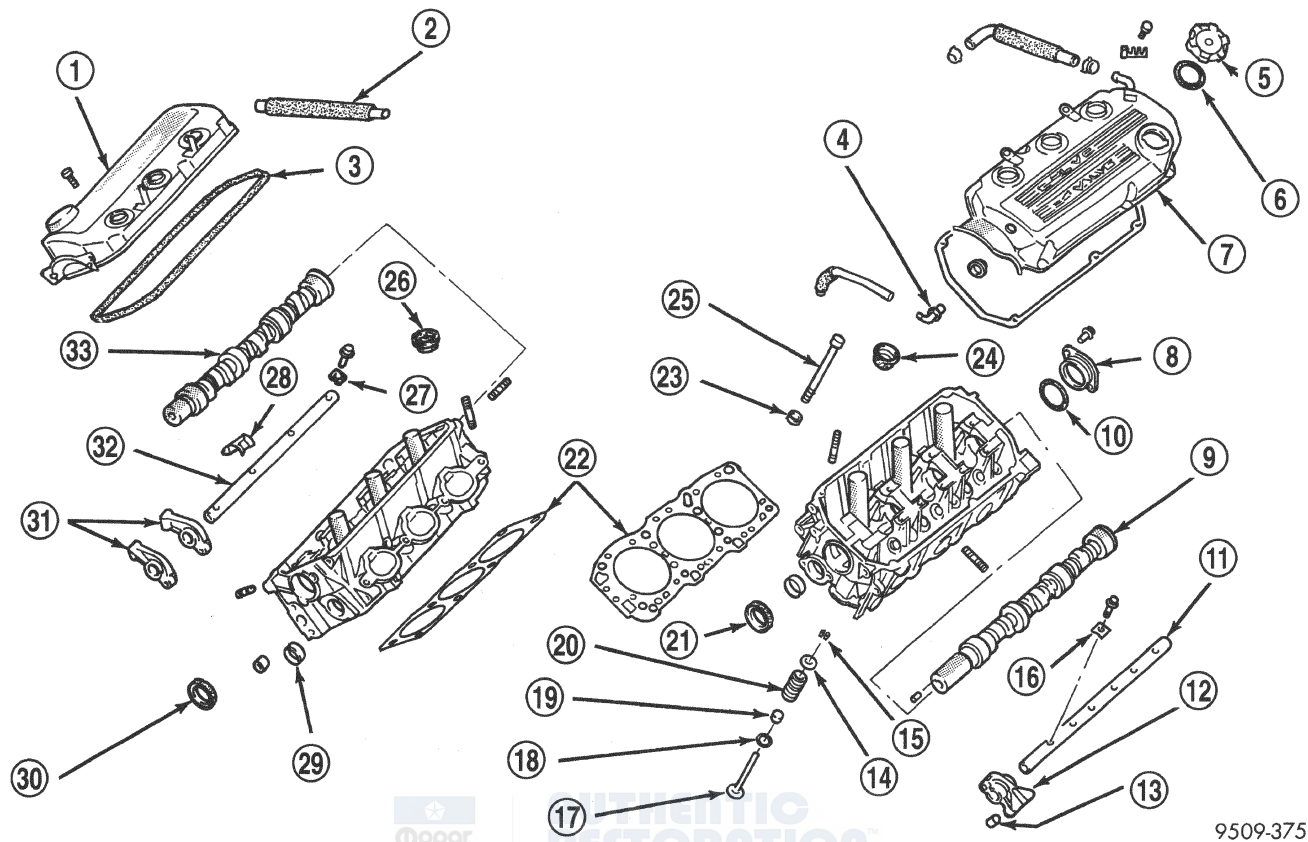
Two overhead camshafts provide valve actuation, one left (front cylinder bank) and one right (rear cylinder bank) (Fig. 4). The distributor is directly driven by the right camshaft. Both camshafts are supported by four bearing journals integral with the cylinder head. A flange at the rear of the camshaft acts as a

thrust collar. Right and left camshaft driving sprockets are interchangeable.

**OPERATION**

The camshafts are driven by the crankshaft via drive sprockets and a belt. The camshafts have precisely machined lobes to provide accurate valve timing and duration.

## DESCRIPTION AND OPERATION (Continued)



9509-375

Fig. 4 Cylinder Head and Valvetrain

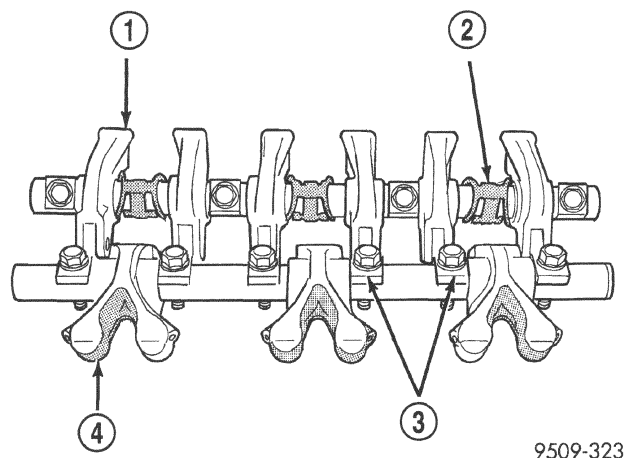
- |                               |                              |
|-------------------------------|------------------------------|
| 1 - CYLINDER HEAD COVER       | 18 - SPRING SEAT             |
| 2 - BREATHER HOSE             | 19 - VALVE STEM SEAL         |
| 3 - GASKET                    | 20 - SPRING                  |
| 4 - PCV VALVE                 | 21 - SEAL                    |
| 5 - OIL FILLER CAP            | 22 - HEAD GASKETS            |
| 6 - GASKET                    | 23 - WASHER                  |
| 7 - CYLINDER HEAD COVER       | 24 - SEAL                    |
| 8 - CAMSHAFT THRUST CASE      | 25 - CYLINDER HEAD BOLT      |
| 9 - CAMSHAFT (LEFT SIDE)      | 26 - SEAL                    |
| 10 - O-RING                   | 27 - CAP                     |
| 11 - EXHAUST ROCKER ARM SHAFT | 28 - SPRING                  |
| 12 - EXHAUST ROCKER ARM       | 29 - CAP                     |
| 13 - HYDRAULIC LASH ADJUSTER  | 30 - SEAL                    |
| 14 - SPRING RETAINER          | 31 - INTAKE ROCKER ARMS      |
| 15 - LOCKS                    | 32 - INTAKE ROCKER ARM SHAFT |
| 16 - CAP                      | 33 - CAMSHAFT (RIGHT SIDE)   |
| 17 - VALVE                    |                              |

## ROCKER ARMS AND SHAFTS

## DESCRIPTION

The rocker arms are made of light weight die-cast with roller type follower operating against the camshaft (Fig. 5). The valve actuating end of the rocker arms are machined for hydraulic lash adjusters, eliminating the need for periodic valve lash adjustment.

The rocker arm shafts are retained by retaining caps and bolts. Four shafts are used, one for each intake and exhaust rocker arm assembly on each cylinder head. The hollow shafts provide a duct for lubricating oil flow from the cylinder head to the valve mechanisms. Rocker shaft springs are use on the intake shafts ONLY to obtain the proper clearance between the intake rocker arms and the spark plug tubes.

**DESCRIPTION AND OPERATION (Continued)**

9509-323

**Fig. 5 Rocker Arms and Shafts**

- 1 - INTAKE ROCKER ARMS
- 2 - ROCKER SHAFT SPRINGS
- 3 - ROCKER ARM SHAFT RETAINERS
- 4 - EXHAUST ROCKER ARMS

**VALVES****DESCRIPTION**

Four valves per cylinder are actuated by die-cast aluminum roller rocker arms and hydraulic lash adjusters assemblies which pivot on rocker arm shafts (Fig. 4). All valves have 6 mm diameter chrome plated valve stems. The valves have a carbonitriding finish for long life. Fluorcarbon valve stem seals are used on both valves. Stamped steel valve spring seat, Valve springs, spring retainers, and locks are conventional.

**INTAKE MANIFOLD****DESCRIPTION**

This intake manifold system (Fig. 6) is composed of a upper intake manifold plenum and a lower manifold. This aluminum alloy manifold has long runners to improve inertia. The upper intake plenum chamber (surge tank) absorbs air pulsations created during the suction phase of each cylinder. The lower intake manifold is machined for six injectors and fuel rail mounting.

**OPERATION**

The intake manifold meters and delivers air to the combustion chambers. This air allows the fuel delivered by the fuel injectors to ignite, thus producing power.

**EXHAUST MANIFOLD****DESCRIPTION**

The exhaust manifolds (Fig. 6) are made of cast nodular graphite iron for heat resistance. Exhaust gasses from the left cylinder bank, leave the left manifold through a stainless steel pipe routed under the engine to the right side manifold. The collected exhaust from both manifolds are combined, and exit to the exhaust pipe through a flex-joint.

**OPERATION**

The exhaust manifold collects the exhaust gasses exiting the combustion chambers. Then it channels the exhaust gasses to the exhaust pipes attached to the manifold.

**ENGINE LUBRICATION SYSTEM****DESCRIPTION**

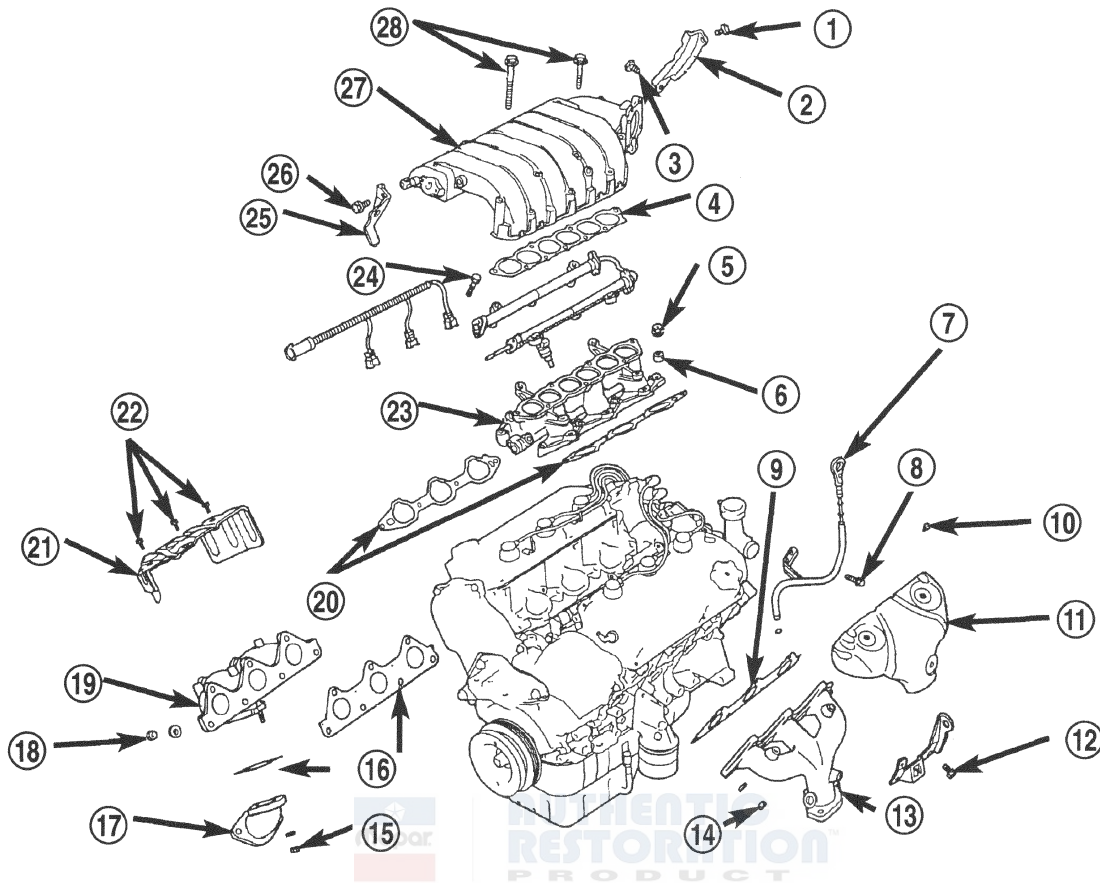
The lubrication system is a full flow filtration pressure feed type. The trochoid type oil pump is mounted to the front of the engine block and is directly coupled to the crankshaft.

**OPERATION**

Engine oil, stored in the oil pan, is taken in and discharged the oil pump. Oil pressure is regulated by a relief valve located in the oil pump housing. The oil is fed through an oil filter and to the crankshaft journals from the oil gallery in the cylinder block. This gallery also feeds oil under pressure to the cylinder heads and camshaft journals. It then flows from the cylinder head passages to the rocker shafts to the rocker arm pivots and auto lash adjusters (Fig. 7).



## DESCRIPTION AND OPERATION (Continued)

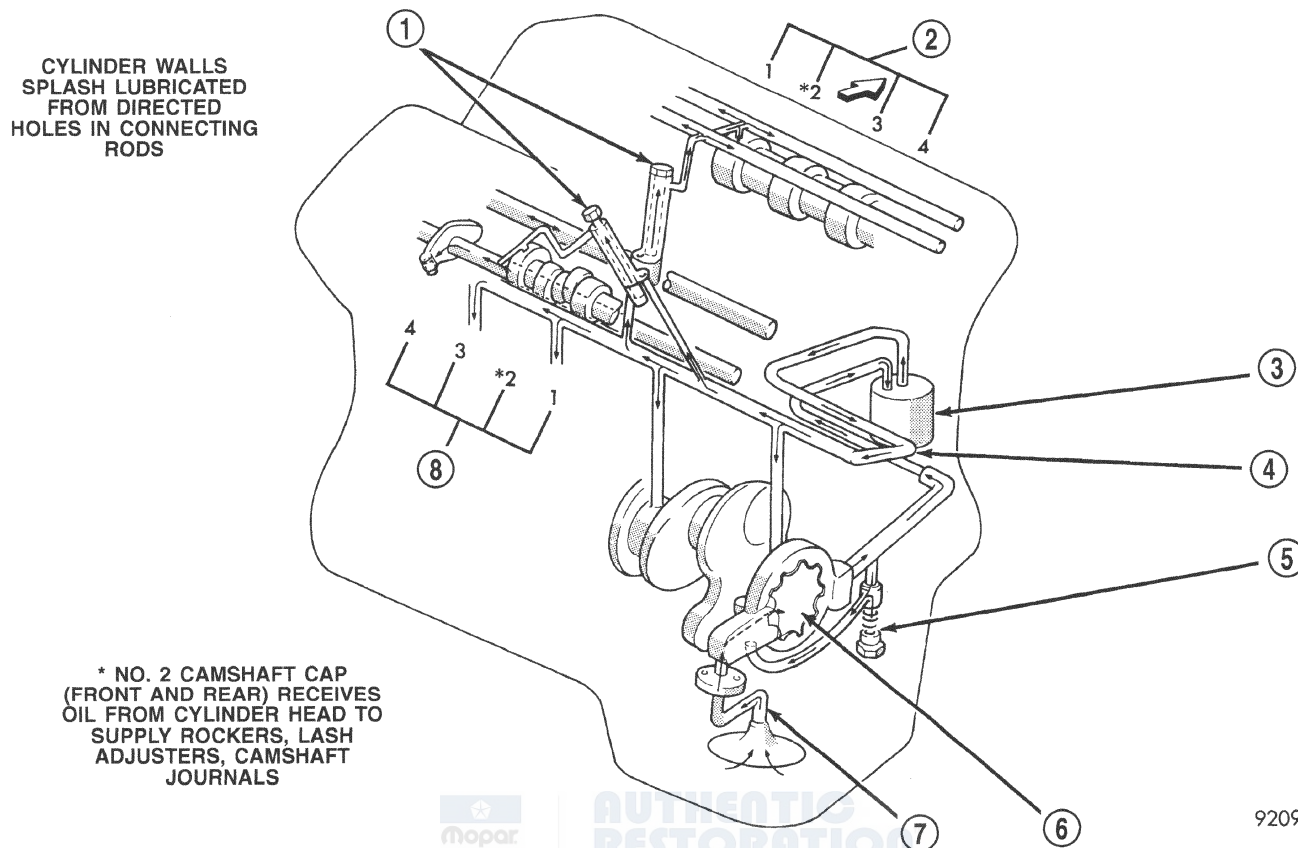


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Fig. 6 Intake and Exhaust Manifolds

- 1 - 18 N•m (13 ft. lbs.)
- 2 - LEFT SIDE MANIFOLD SUPPORT
- 3 - 36 N•m (26 ft. lbs.)
- 4 - GASKET
- 5 - NUT
- 6 - SPRING WASHER
- 7 - OIL DIPSTICK AND TUBE
- 8 - 23 N•m (17 ft. lbs.)
- 9 - GASKET
- 10 - 13 N•m (10 ft. lbs.)
- 11 - FRONT HEAT SHIELD
- 12 - 36 N•m (26 ft. lbs.)
- 13 - FRONT EXHAUST MANIFOLD
- 14 - 30 N•m (22 ft. lbs.)

- 15 - NUT 59 N•m (43 ft. lbs.)
- 16 - GASKETS
- 17 - EXHAUST MANIFOLD
- 18 - 30 N•m (22 ft. lbs.)
- 19 - REAR EXHAUST MANIFOLD
- 20 - LOWER INTAKE MANIFOLD GASKETS
- 21 - REAR HEAT SHIELD
- 22 - 13 N•m (10 ft. lbs.)
- 23 - LOWER INTAKE MANIFOLD
- 24 - 12 N•m (8 ft. lbs.)
- 25 - RIGHT SIDE MANIFOLD SUPPORT
- 26 - 18 N•m (13 ft. lbs.)
- 27 - UPPER INTAKE MANIFOLD
- 28 - 18 N•m (13 ft. lbs.)

**DESCRIPTION AND OPERATION (Continued)****Fig. 7 Engine Lubrication System****DIAGNOSIS AND TESTING****ENGINE DIAGNOSIS—INTRODUCTION**

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either mechanical (e.g., a strange noise), or performance (e.g., engine idles rough and stalls).

Refer to the Service Diagnosis—Mechanical Chart and the Service Diagnosis—Performance Chart, for possible causes and corrections of malfunctions. Refer

to Group 14, Fuel System, for the fuel system diagnosis.

Additional tests and diagnostic procedures may be necessary for specific engine malfunctions that cannot be isolated with the Service Diagnosis charts. Information concerning additional tests and diagnosis is provided within the following:

- Cylinder Compression Pressure Test
- Cylinder Combustion Pressure Leakage Test
- Engine Cylinder Head Gasket Failure Diagnosis
- Intake Manifold Leakage Diagnosis
- Lash Adjuster (Tappet) Noise Diagnosis
- Engine Oil Leak Inspection

**DIAGNOSIS AND TESTING (Continued)****ENGINE DIAGNOSIS—PERFORMANCE**

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	<ol style="list-style-type: none"> <li>1. Weak battery.</li> <li>2. Corroded or loose battery connections.</li> <li>3. Faulty starter.</li> <li>4. Faulty coil(s) or control unit.</li> <li>5. Incorrect spark plug gap.</li> <li>6. Contamination in fuel system.</li> <li>7. Faulty fuel pump.</li> <li>8. Incorrect engine timing.</li> </ol>	<ol style="list-style-type: none"> <li>1. Test battery. Charge or replace as necessary. Refer to Group 8A, Battery.</li> <li>2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals.</li> <li>3. Test starting system. Refer to Group 8B, Starting.</li> <li>4. Test and replace as needed. Refer to Group 8D, Ignition System.</li> <li>5. Set gap. Refer to Group 8D, Ignition System.</li> <li>6. Clean system and replace fuel filter.</li> <li>7. Test fuel pump and replace as needed. Refer to Group 14, Fuel System.</li> <li>8. Check for a skipped timing belt/chain.</li> </ol>
ENGINE STALLS OR IDLES ROUGH	<ol style="list-style-type: none"> <li>1. Idle speed too low.</li> <li>2. Incorrect fuel mixture.</li> <li>3. Intake manifold leakage.</li> <li>4. Faulty coil(s).</li> </ol>	<ol style="list-style-type: none"> <li>1. Test minimum air flow. Refer to Group 14, Fuel System.</li> <li>2. Refer to Group 14, Fuel System.</li> <li>3. Inspect intake manifold, manifold gasket, and vacuum hoses.</li> <li>4. Test and replace as necessary. Refer to Group 8D, Ignition System.</li> </ol>
ENGINE LOSS OF POWER	<ol style="list-style-type: none"> <li>1. Dirty or incorrectly gapped plugs.</li> <li>2. Contamination in fuel system.</li> <li>3. Faulty fuel pump.</li> <li>4. Incorrect valve timing.</li> <li>5. Leaking cylinder head gasket.</li> <li>6. Low compression.</li> <li>7. Burned, warped, or pitted valves.</li> <li>8. Plugged or restricted exhaust system.</li> <li>9. Faulty coil(s).</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean plugs and set gap. Refer to Group 8D, Ignition System.</li> <li>2. Clean system and replace fuel filter.</li> <li>3. Test and replace as necessary. Refer to Group 14, Fuel System.</li> <li>4. Correct valve timing.</li> <li>5. Replace cylinder head gasket.</li> <li>6. Test compression of each cylinder.</li> <li>7. Replace valves.</li> <li>8. Install new parts, as necessary.</li> <li>9. Test and replace as necessary. Refer to Group 8D, Ignition System.</li> </ol>

**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE MISSES ON ACCELERATION	<ol style="list-style-type: none"> <li>1. Dirty or incorrectly gapped spark plugs.</li> <li>2. Contamination in Fuel System.</li> <li>3. Burned, warped, or pitted valves.</li> <li>4. Faulty coil(s).</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean spark plugs and set gap. Refer to Group 8D, Ignition System.</li> <li>2. Clean fuel system and replace fuel filter.</li> <li>3. Replace valves.</li> <li>4. Test and replace as necessary. Refer to Group 8D, Ignition System.</li> </ol>
ENGINE MISSES AT HIGH SPEED	<ol style="list-style-type: none"> <li>1. Dirty or incorrect spark plug gap.</li> <li>2. Faulty coil(s).</li> <li>3. Dirty fuel injector(s).</li> <li>4. Contamination in fuel system.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean spark plugs and set gap. Refer to Group 8D, Ignition System.</li> <li>2. Test and replace as necessary. Refer to Group 8D, Ignition System.</li> <li>Test and replace as necessary. Refer to Group 14, Fuel System.</li> <li>4. Clean system and replace fuel filter.</li> </ol>

**ENGINE DIAGNOSIS—MECHANICAL**

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY VALVES	<ol style="list-style-type: none"> <li>1. High or low oil level in crankcase.</li> <li>2. Thin or diluted oil.</li> <li>3. Low oil pressure.</li> <li>4. Dirt in tappets/lash adjusters.</li> <li>5. Worn rocker arms.</li> <li>6. Worn tappets/lash adjusters.</li> <li>7. Worn valve guides.</li> <li>8. Excessive runout of valve seats on valve faces.</li> <li>9. Missing adjuster pivot.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and correct engine oil level.</li> <li>2. Change oil to correct viscosity.</li> <li>3. Check and correct engine oil level.</li> <li>4. Replace rocker arm/hydraulic lash adjuster assembly.</li> <li>5. Inspect oil supply to rocker arms.</li> <li>6. Install new rocker arm/hydraulic lash adjuster assembly.</li> <li>7. Ream guides and install new valves with oversize stems.</li> <li>8. Grind valve seats and valves.</li> <li>9. Replace rocker arm/hydraulic lash adjuster assembly.</li> </ol>
CONNECTING ROD NOISE	<ol style="list-style-type: none"> <li>1. Insufficient oil supply.</li> <li>2. Low oil pressure.</li> <li>3. Thin or diluted oil.</li> <li>4. Excessive bearing clearance.</li> <li>5. Connecting rod journal out-of-round.</li> <li>6. Misaligned connecting rods.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check engine oil level.</li> <li>2. Check engine oil level. Inspect oil pump relief valve and spring.</li> <li>3. Change oil to correct viscosity.</li> <li>4. Measure bearings for correct clearance. Repair as necessary.</li> <li>5. Replace crankshaft or grind surface.</li> <li>6. Replace bent connecting rods.</li> </ol>



**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSES	CORRECTION
MAIN BEARING NOISE	<ol style="list-style-type: none"> <li>1. Insufficient oil supply.</li> <li>2. Low oil pressure.</li> <li>3. Thin or diluted oil.</li> <li>4. Excessive bearing clearance.</li> <li>5. Excessive end play.</li> <li>6. Crankshaft journal out-of-round or worn.</li> <li>7. Loose flywheel or torque converter.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check engine oil level.</li> <li>2. Check engine oil level. Inspect oil pump relief valve and spring.</li> <li>3. Change oil to correct viscosity.</li> <li>4. Measure bearings for correct clearance. Repair as necessary.</li> <li>5. Check thrust bearing for wear on flanges.</li> <li>6. Replace crankshaft or grind journals.</li> <li>7. Tighten to correct torque.</li> </ol>
OIL PRESSURE DROP	<ol style="list-style-type: none"> <li>1. Low oil level.</li> <li>2. Faulty oil pressure sending unit.</li> <li>3. Low oil pressure.</li> <li>4. Clogged oil filter.</li> <li>5. Worn parts in oil pump.</li> <li>6. Thin or diluted oil.</li> <li>7. Oil pump relief valve stuck.</li> <li>8. Oil pump suction tube loose.</li> <li>9. Oil pump cover warped or cracked.</li> <li>10. Excessive bearing clearance.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check engine oil level.</li> <li>2. Install new sending unit.</li> <li>3. Check sending unit and main bearing oil clearance.</li> <li>4. Install new oil filter.</li> <li>5. Replace worn parts or pump.</li> <li>6. Change oil to correct viscosity.</li> <li>7. Remove valve and inspect, clean, or replace.</li> <li>8. Remove oil pan and install new tube or clean, if necessary.</li> <li>9. Install new oil pump.</li> <li>10. Measure bearings for correct clearance.</li> </ol>
OIL LEAKS	<ol style="list-style-type: none"> <li>1. Misaligned or deteriorated gaskets.</li> <li>2. Loose fastener, broken or porous metal part.</li> <li>3. Misaligned or deteriorated cup or threaded plug.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace gasket(s).</li> <li>2. Tighten, repair or replace the part.</li> <li>3. Replace as necessary.</li> </ol>

**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL CONSUMPTION OR SPARK PLUGS FOULED	<ol style="list-style-type: none"> <li>1. PCV system malfunction.</li> <li>2. Worn, scuffed or broken rings.</li> <li>3. Carbon in oil ring slots.</li> <li>4. Rings fitted too tightly in grooves.</li> <li>5. Worn valve guide(s).</li> <li>6. Valve stem seal(s) worn or damaged.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check system and repair as necessary. Refer to Group 25, Emission Control Systems.</li> <li>2. Hone cylinder bores. Install new rings.</li> <li>3. Install new rings.</li> <li>4. Remove rings and check grooves. If groove is not proper width, replace piston.</li> <li>5. Ream guide(s) and replace valve(s) with oversize valve(s) and seal(s).</li> <li>6. Replace seal(s).</li> </ol>

**HYDROSTATIC LOCKED ENGINE**

When an engine is suspected to be hydrostatically locked, regardless of what caused the problem, the following steps should be used.

**CAUTION: DO NOT use starter motor to rotate the engine, severe damage may occur.**

(1) Inspect air cleaner, induction system and intake manifold to insure system is dry and clear of foreign material.

(2) Remove negative battery cable.

(3) Place a shop towel around the spark plugs when removing them from the engine. This will catch any fluid that may possibly be in the cylinder under pressure.

(4) With all spark plugs removed, rotate engine crankshaft using a breaker bar and socket.

(5) Identify the fluid in the cylinder(s) (i.e., coolant, fuel, oil or other).

(6) Make sure all fluid has been removed from the cylinders. Inspect engine for damage (i.e., connecting rods, pistons, valves, etc.)

(7) Repair engine or components as necessary to prevent this problem from re-occurring.

**CAUTION: Squirt approximately one teaspoon of oil into the cylinders, rotate engine to lubricate the cylinder walls to prevent damage on restart.**

(8) Install new spark plugs.

(9) Drain engine oil and remove oil filter.

(10) Fill engine with specified amount of approved oil and install new oil filter.

(11) Connect negative battery cable.

(12) Start engine and check for any leaks.

**INTAKE MANIFOLD LEAKAGE DIAGNOSIS**

An intake manifold air leak is characterized by lower than normal manifold vacuum. Also, one or more cylinders may not be functioning.

**WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR THE FAN. DO NOT WEAR LOOSE CLOTHING.**

(1) Start the engine.

(2) Spray a small stream of water (Spray Bottle) at the suspected leak area.

(3) If engine RPM'S change, the area of the suspected leak has been found.

(4) Repair as required.

**CYLINDER COMPRESSION PRESSURE TEST**

The results of a cylinder compression pressure test can be utilized to diagnose several engine malfunctions.

Ensure the battery is completely charged and the engine starter motor is in good operating condition. Otherwise the indicated compression pressures may not be valid for diagnosis purposes.

(1) Check engine oil level and add oil if necessary.

(2) Drive the vehicle until engine reaches normal operating temperature. Select a route free from traffic and other forms of congestion, observe all traffic laws, and accelerate through the gears several times briskly.

(3) Remove all spark plugs from engine. As spark plugs are being removed, check electrodes for abnormal firing indicators fouled, hot, oily, etc. Record cylinder number of spark plug for future reference.

## DIAGNOSIS AND TESTING (Continued)

(4) Disconnect coil wire from distributor and secure to good ground to prevent a spark from starting a fire (Conventional Ignition System). For Direct Ignition System DIS disconnect the coil connector.

(5) Be sure throttle blade is fully open during the compression check.

(6) Insert compression gage adaptor Special Tool 8116 or the equivalent, into the #1 spark plug hole in cylinder head. Connect the 0–500 psi (Blue) pressure transducer with cable adaptors to the DRBIII®.

(7) Crank engine until maximum pressure is reached on gage. Record this pressure as #1 cylinder pressure.

(8) Repeat the previous step for all remaining cylinders.

(9) Compression should not be less than 689 kPa (100 psi) and not vary more than 25 percent from cylinder to cylinder.

(10) If one or more cylinders have abnormally low compression pressures, repeat the compression test.

(11) If the same cylinder or cylinders repeat an abnormally low reading on the second compression test, it could indicate the existence of a problem in the cylinder in question. **The recommended compression pressures are to be used only as a guide to diagnosing engine problems. An engine should not be disassembled to determine the cause of low compression unless some malfunction is present.**

## CYLINDER COMBUSTION PRESSURE LEAKAGE TEST

The combustion pressure leakage test provides an accurate means for determining engine condition.

Combustion pressure leakage testing will detect:

- Exhaust and intake valve leaks (improper seating).
- Leaks between adjacent cylinders or into water jacket.
- Any causes for combustion/compression pressure loss.

**WARNING: DO NOT REMOVE THE RADIATOR CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.**

Check the coolant level and fill as required. DO NOT install the radiator cap.

Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

Clean spark plug recesses with compressed air.

Remove the spark plugs.

Remove the oil filler cap.

Remove the air cleaner.

Calibrate the tester according to the manufacturer's instructions. The shop air source for testing should maintain 483 kPa (70 psi) minimum, 1,379 kPa (200 psi) maximum, with 552 kPa (80 psi) recommended.

Perform the test procedures on each cylinder according to the tester manufacturer's instructions. While testing, listen for pressurized air escaping through the throttle body, tailpipe and oil filler cap opening. Check for bubbles in the radiator coolant.

All gauge pressure indications should be equal, with no more than 25% leakage per cylinder.

**FOR EXAMPLE:** At 552 kPa (80 psi) input pressure, a minimum of 414 kPa (60 psi) should be maintained in the cylinder.

## ENGINE CYLINDER HEAD GASKET FAILURE DIAGNOSIS

A leaking engine cylinder head gasket usually results in loss of power, loss of coolant, and engine misfiring.

An engine cylinder head gasket leak can be located between adjacent cylinders or between a cylinder and the adjacent water jacket.

- An engine cylinder head gasket leaking between adjacent cylinders is indicated by a loss of power and/or engine misfire.
- An engine cylinder head gasket leaking between a cylinder and an adjacent water jacket is indicated by coolant foaming or overheating and loss of coolant.

## CYLINDER-TO-CYLINDER LEAKAGE TEST

To determine if an engine cylinder head gasket is leaking between adjacent cylinders, follow the procedures outlined in Cylinder Compression Pressure Test. An engine cylinder head gasket leaking between adjacent cylinders will result in approximately a 50-70% reduction in compression pressure.

## CYLINDER-TO-WATER JACKET LEAKAGE TEST

**WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS, OR THE FAN. DO NOT WEAR LOOSE CLOTHING.**

Remove the radiator cap.

Start the engine and allow it to warm up until the engine thermostat opens.

If a large combustion/compression pressure leak exists, bubbles will be visible in the coolant.

If bubbles are not visible, perform either of the following procedures:



## DIAGNOSIS AND TESTING (Continued)

### PRESSURE TEST

- Install cooling system tester Special Tool 7700 or equivalent, and pressurize the coolant system.
- If a cylinder is leaking combustion pressure into the water jacket, the tester pointer will pulsate with every combustion stroke of the cylinder.

### CHEMICAL TEST

- This procedure involves using Bloc-Chek Test Kit, Special Tool C-3685-A or the equivalent. Perform test procedure following the instructions included with the test kit.

### LASH ADJUSTER (TAPPET) NOISE DIAGNOSIS

A tappet-like noise may be produced from several items. Check the following items.

- (1) Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.
- (2) Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.
- (3) During this time, turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.
- (4) Low oil pressure.
- (5) The oil restrictor pressed into the vertical oil passage to the cylinder head is plugged with debris.
- (6) Air ingested into oil due to broken or cracked oil pump pick up.
- (7) Worn valve guides.
- (8) Rocker arm ears contacting valve spring retainer.
- (9) Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.
- (10) Faulty lash adjuster.
  - a. Check lash adjusters for sponginess while installed in cylinder head. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.
  - b. Remove suspected lash adjusters, and replace as necessary.

### ENGINE OIL LEAK INSPECTION

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

- (1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.
- (2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to

make sure the dye is thoroughly mixed as indicated with a bright yellow color under a black light.

- (3) Using a black light, inspect the entire engine for fluorescent dye, particularly at the suspected area of oil leak. If the oil leak is found and identified, repair per service manual instructions.

- (4) If dye is not observed, drive the vehicle at various speeds for approximately 24 km (15 miles), and repeat inspection.

- (5) **If the oil leak source is not positively identified at this time**, proceed with the air leak detection test method as follows:

- Disconnect the fresh air hose (make-up air) at the cylinder head cover and plug or cap the nipple on the cover.
- Remove the PCV valve hose from the cylinder head cover. Cap or plug the PCV valve nipple on the cover.
- Attach an air hose with pressure gauge and regulator to the dipstick tube.

**CAUTION: Do not subject the engine assembly to more than 20.6 kpa (3 PSI) of test pressure.**

- Gradually apply air pressure from 1 psi to 2.5 psi maximum while applying soapy water at the suspected source. Adjust the regulator to the suitable test pressure that provides the best bubbles which will pinpoint the leak source. If the oil leak is detected and identified, repair per service manual procedures.

- If the leakage occurs at the crankshaft rear oil seal area, refer to the section, Inspection for Rear Seal Area Leak.

- (6) If no leaks are detected, turn off the air supply. Remove the air hose, all plugs, and caps. Install the PCV valve and fresh air hose (make-up air). Proceed to next step.

- (7) Clean the oil off the suspect oil leak area using a suitable solvent. Drive the vehicle at various speeds approximately 24 km (15 miles). Inspect the engine for signs of an oil leak by using a black light.

### INSPECTION FOR REAR SEAL AREA LEAKS

Since it is sometimes difficult to determine the source of an oil leak in the rear seal area of the engine, a more involved inspection is necessary. The following steps should be followed to help pinpoint the source of the leak.

If the leakage occurs at the crankshaft rear oil seal area:

- (1) Disconnect the battery.
- (2) Raise the vehicle.
- (3) Remove torque converter or clutch housing cover and inspect rear of block for evidence of oil. Use a black light to check for the oil leak. If a leak is



## DIAGNOSIS AND TESTING (Continued)

present in this area, remove transmission for further inspection.

(a) Circular spray pattern generally indicates seal leakage or crankshaft damage.

(b) Where leakage tends to run straight down, possible causes are a porous block, oil gallery cup plug, bedplate to cylinder block mating surfaces and seal bore. See proper repair procedures for these items.

(4) If no leaks are detected, pressurize the crankcase as previously described.

**CAUTION:** Do not exceed 20.6 kPa (3 psi).

(5) If the leak is not detected, very slowly turn the crankshaft and watch for leakage. If a leak is detected between the crankshaft and seal while slowly turning the crankshaft, it is possible the crankshaft seal surface is damaged. The seal area on the crankshaft could have minor nicks or scratches that can be polished out with emery cloth.

**CAUTION:** Use extreme caution when crankshaft polishing is necessary to remove minor nicks and scratches. The crankshaft seal flange is especially machined to complement the function of the rear oil seal.

(6) For bubbles that remain steady with shaft rotation, no further inspection can be done until disassembled.

(7) After the oil leak root cause and appropriate corrective action have been identified, refer to Crank-

shaft Oil Seal—Rear for proper replacement procedures.

## ENGINE OIL PRESSURE CHECKING

Check oil pressure using gauge at oil pressure switch location. Oil pressure should be 41 kPa (6 psi.) at idle or 241 to 517 kPa (35 to 75 psi.) at 3000 RPM.

(1) Remove pressure sending unit and install oil pressure gauge.

**CAUTION:** If oil pressure is 0 at idle, Do Not Run engine at 3000 RPM.

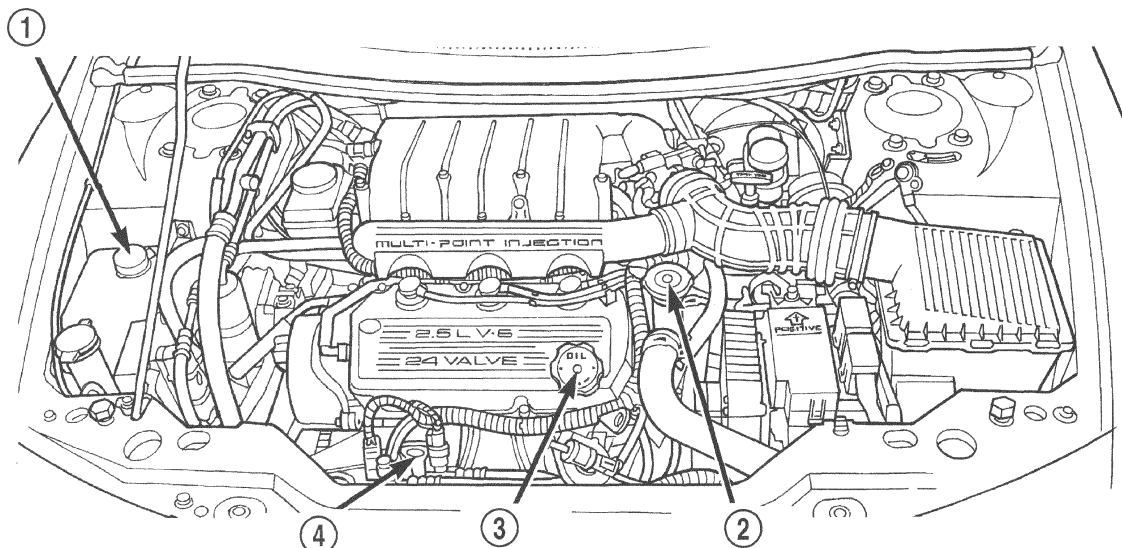
(2) Warm engine at high idle until thermostat opens.

## SERVICE PROCEDURES

### ENGINE OIL LEVEL CHECK

The best time to check engine oil level is after it has sat overnight, or if the engine has been running, allow the engine to be shut off for at least 5 minutes before checking oil level.

Checking the oil while the vehicle is on level ground will improve the accuracy of the oil level reading. Remove dipstick (Fig. 8), and observe oil level. Add oil only when the level is at or below the ADD mark (Fig. 9).

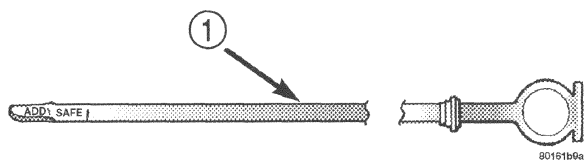


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**Fig. 8 Dipstick and Engine Oil Fill Locations—2.5L**

1 - COOLANT RECOVERY CONTAINER  
2 - COOLANT PRESSURE CAP

3 - ENGINE OIL FILL  
4 - ENGINE OIL DIPSTICK

**SERVICE PROCEDURES (Continued)****Fig. 9 Oil Level**

1 - ENGINE OIL LEVEL DIPSTICK

**ENGINE OIL SERVICE**

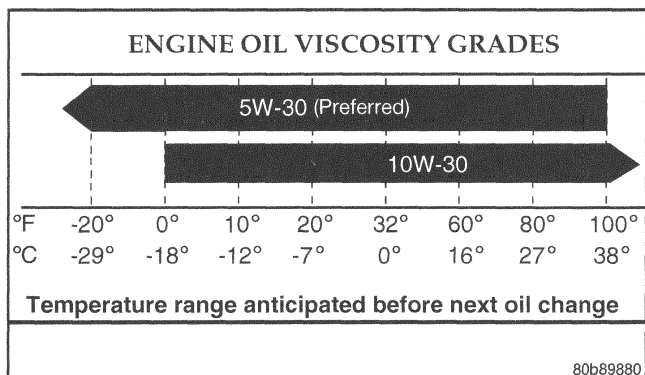
**WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.**

**API SERVICE GRADE CERTIFIED**

Use an engine oil that is API Service Grade Certified. MOPAR® provides engine oils that conform to this service grade.

**SAE VISCOSITY**

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation (Fig. 10).

**Fig. 10 Temperature/Engine Oil Viscosity****ENERGY CONSERVING OIL**

An Energy Conserving type oil is recommended for gasoline engines. The designation of ENERGY CONSERVING is located on the label of an engine oil container.

**CONTAINER IDENTIFICATION**

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 11).



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**Fig. 11 Engine Oil Container Standard Notations****ENGINE OIL CHANGE****CHANGING ENGINE OIL**

Change engine oil at mileage and time intervals described in the Maintenance Schedule. Refer to Group 0, Lubrication and Maintenance.

**WARNING: NEW OR USED ENGINE OIL CAN BE IRRITATING TO THE SKIN. AVOID PROLONGED OR REPEATED SKIN CONTACT WITH ENGINE OIL. CONTAMINANTS IN USED ENGINE OIL, CAUSED BY INTERNAL COMBUSTION, CAN BE HAZARDOUS TO YOUR HEALTH. THOROUGHLY WASH EXPOSED SKIN WITH SOAP AND WATER. DO NOT WASH SKIN WITH GASOLINE, DIESEL FUEL, THINNER, OR SOLVENTS, HEALTH PROBLEMS CAN RESULT. DO NOT POLLUTE, DISPOSE OF USED ENGINE OIL PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA.**

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands. Refer to Hoisting and Jacking Recommendations.

(3) Remove oil fill cap. Refer to (Fig. 8).

(4) Place a suitable drain pan under crankcase drain.

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for



## SERVICE PROCEDURES (Continued)

stretching or other damage. Replace drain plug and gasket if damaged.

- (6) Install drain plug in crankcase.
- (7) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.
- (8) Install oil fill cap.
- (9) Start engine and inspect for leaks.
- (10) Stop engine and inspect oil level.

## ENGINE OIL FILTER CHANGE

### FILTER SPECIFICATION

All engines are equipped with a high quality full-flow, disposable type oil filter. Replace oil filter with a Mopar® or the equivalent.

### OIL FILTER REMOVAL

Refer to Removal and Installation Section in Group 9, Engine for procedure.

### USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING listed above.

## FORM-IN-PLACE GASKETS & SEALERS

There are numerous places where form-in-place gaskets are used on the engine. Care must be taken when applying form-in-place gaskets to assure obtaining the desired results. **Do not use form-in-place gasket material unless specified.** Bead size, continuity, and location are of great importance. Too thin a bead can result in leakage while too much can result in spill-over which can break off and obstruct fluid feed lines. A continuous bead of the proper width is essential to obtain a leak-free gasket.

There are numerous types of form-in-place gasket materials that are used in the engine area. Mopar® Engine RTV GEN II, Mopar® ATF-RTV, and Mopar® Gasket Maker gasket materials, each have different properties and can not be used in place of the other.

### MOPAR® ENGINE RTV GEN II

Mopar® Engine RTV GEN II is used to seal components exposed to engine oil. This material is a specially designed black silicone rubber RTV that retains adhesion and sealing properties when exposed to engine oil. Moisture in the air causes the material to cure. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

### MOPAR® ATF RTV

Mopar® ATF RTV is a specifically designed black silicone rubber RTV that retains adhesion and seal-

ing properties to seal components exposed to automatic transmission fluid, engine coolants, and moisture. This material is available in three ounce tubes and has a shelf life of one year. After one year this material will not properly cure. Always inspect the package for the expiration date before use.

### MOPAR® GASKET MAKER

Mopar® Gasket Maker is an anaerobic type gasket material. The material cures in the absence of air when squeezed between two metallic surfaces. It will not cure if left in the uncovered tube. The anaerobic material is for use between two machined surfaces. Do not use on flexible metal flanges.

### MOPAR® BED PLATE SEALANT

Mopar® Bed Plate Sealant is a unique (green-in-color) anaerobic type gasket material that is specially made to seal the area between the bedplate and cylinder block without disturbing the bearing clearance or alignment of these components. The material cures slowly in the absence of air when torqued between two metallic surfaces, and will rapidly cure when heat is applied.

### MOPAR® GASKET SEALANT

Mopar® Gasket Sealant is a slow drying, permanently soft sealer. This material is recommended for sealing threaded fittings and gaskets against leakage of oil and coolant. Can be used on threaded and machined parts under all temperatures. This material is used on engines with multi-layer steel (MLS) cylinder head gaskets. This material also will prevent corrosion. Mopar® Gasket Sealant is available in a 13 oz. aerosol can or 4oz./16 oz. can w/applicator.

## FORM-IN-PLACE GASKET AND SEALER APPLICATION

Assembling parts using a form-in-place gasket requires care but it's easier then using precut gaskets.

Mopar® Gasket Maker material should be applied sparingly 1 mm (0.040 in.) diameter or less of sealant to one gasket surface. Be certain the material surrounds each mounting hole. Excess material can easily be wiped off. Components should be torqued in place within 15 minutes. The use of a locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Engine RTV GEN II or ATF RTV gasket material should be applied in a continuous bead approximately 3 mm (0.120 in.) in diameter. All mounting holes must be circled. For corner sealing, a 3.17 or 6.35 mm (1/8 or 1/4 in.) drop is placed in the center of the gasket contact area. Uncured sealant may be removed with a shop towel. Components should be torqued in place while the sealant is still wet to the touch (within 10 minutes). The usage of a

## SERVICE PROCEDURES (Continued)

locating dowel is recommended during assembly to prevent smearing material off the location.

Mopar® Gasket Sealant in an aerosol can should be applied using a thin, even coat sprayed completely over both surfaces to be joined, and both sides of a gasket. Then proceed with assembly. Material in a can w/applicator can be brushed on evenly over the sealing surfaces. Material in an aerosol can should be used on engines with multi-layer steel gaskets.

## ENGINE GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

**Never** use the following to clean gasket surfaces:

- Metal scraper
- Abrasive pad or paper to clean cylinder block and head
- High speed power tool with an abrasive pad or a wire brush (Fig. 12)

**NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.**

Only use the following for cleaning gasket surfaces:

- Solvent or a commercially available gasket remover
- Plastic or wood scraper (Fig. 12)
- Drill motor with 3M Roloc™ Bristle Disc (white or yellow) (Fig. 12)

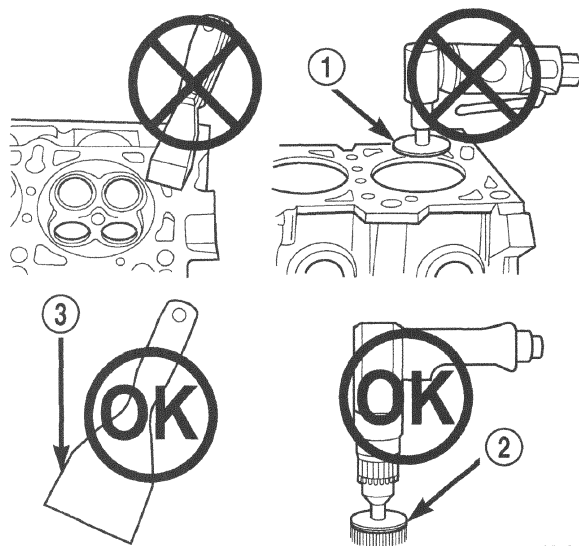
**CAUTION: Excessive pressure or high RPM (beyond the recommended speed), can damage the sealing surfaces. The mild (white, 120 grit) bristle disc is recommended. If necessary, the medium (yellow, 80 grit) bristle disc may be used on cast iron surfaces with care.**

## REPAIR OF DAMAGED OR WORN THREADS

Damaged or worn threads (including aluminum head spark plug threads) can be repaired. Essentially, this repair consists of drilling out worn or damaged threads, tapping the hole with a special Heli-Coil Tap, (or equivalent) and installing an insert into the tapped hole. This brings the hole back to its original thread size.

**CAUTION: Be sure that the tapped holes maintain the original centerline.**

Heli-Coil tools and inserts are readily available from automotive parts jobbers.



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**Fig. 12 Proper Tool Usage For Surface Preparation**

- 1 - ABRASIVE PAD  
2 - 3M ROLOC™ BRISTLE DISC  
3 - PLASTIC/WOOD SCRAPER

## CYLINDER BORE—HONING

(1) Used carefully, the cylinder bore resizing hone, recommended tool C-823 or equivalent, equipped with 220 grit stones, is the best tool for this honing procedure. In addition to deglazing, it will reduce taper and out-of-round as well as removing light scuffing, scoring or scratches. Usually a few strokes will clean up a bore and maintain the required limits.

(2) Deglazing of the cylinder walls may be done using a cylinder surfacing hone, recommended tool C-3501 or equivalent, equipped with 280 grit stones, if the cylinder bore is straight and round. 20–60 strokes depending on the bore condition, will be sufficient to provide a satisfactory surface. Inspect cylinder walls after each 20 strokes, using a light honing oil. **Do not use engine or transmission oil, mineral spirits or kerosene.**

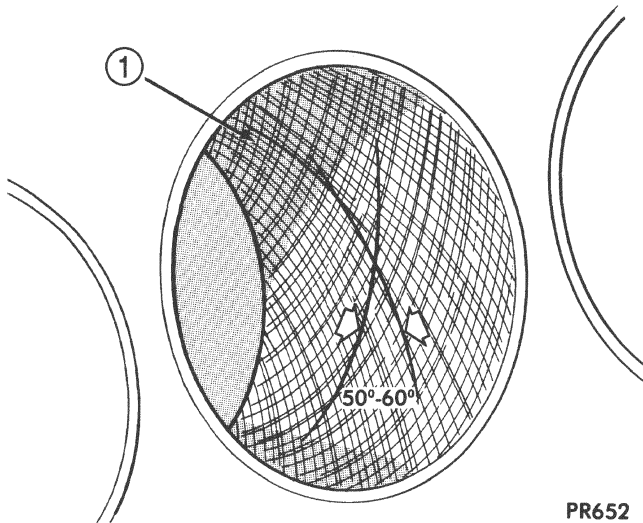
(3) Honing should be done by moving the hone up and down fast enough to get a cross-hatch pattern. When hone marks **intersect** at 50–60 degrees, the cross hatch angle is most satisfactory for proper seating of rings (Fig. 13).

(4) A controlled hone motor speed between 200–300 RPM is necessary to obtain the proper cross-hatch angle. The number of up and down strokes per minute can be regulated to get the desired 50–60 degree angle. Faster up and down strokes increase the cross-hatch angle.

(5) After honing, it is necessary that the block be cleaned again to remove all traces of abrasive.



## SERVICE PROCEDURES (Continued)



**Fig. 13 Cylinder Bore Cross-Hatch Pattern**

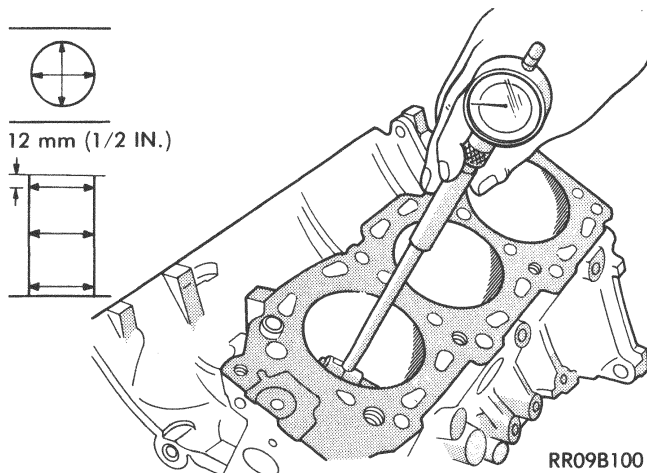
1 - CROSS-HATCH PATTERN

**CAUTION:** Ensure all abrasives are removed from engine parts after honing. It is recommended that a solution of soap and hot water be used with a brush and the parts then thoroughly dried. The bore can be considered clean when it can be wiped clean with a white cloth and cloth remains clean. Oil the bores after cleaning to prevent rusting.

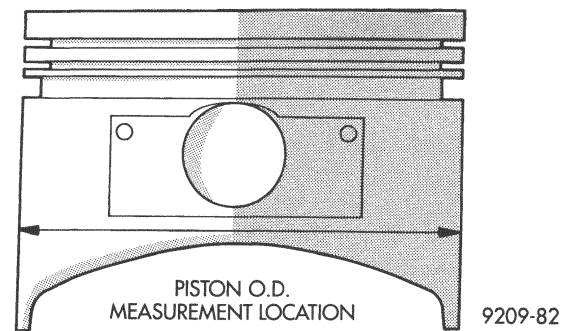
### CYLINDER—BORING

Examine cylinder walls for scuffs, scoring and measure cylinder bore for out-of-round or taper. If defective, bore cylinder to oversize. Measure at points shown in (Fig. 14).

Four oversize pistons are available (0.25mm (.010 inch) 0.50mm (.020 inch) 0.75mm (.030 inch) and 1.0mm (.039 inch). Determine oversize piston on basis of largest cylinder bore.



**Fig. 14 Measure Cylinder Bore**



**Fig. 15 Measure Piston**

(1) Bore to specified clearance between the piston O. D. and cylinder. The measuring point of the piston O. D. is shown in (Fig. 15).

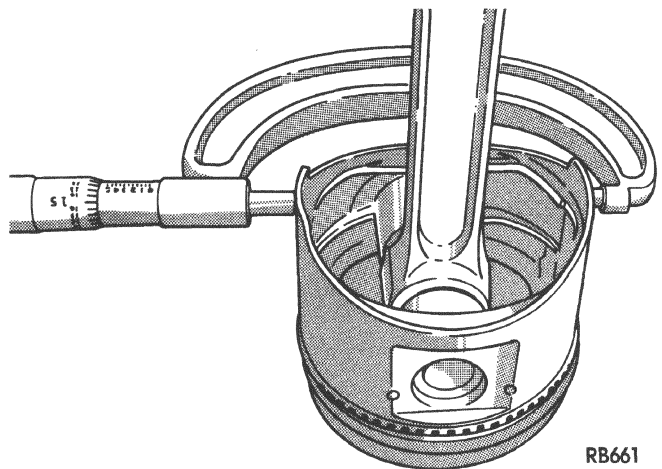
(2) Based on measured piston O. D., calculate boring finish dimension. Boring finish dimension equals piston O. D. plus 0.03 to 0.05 mm (.0012 to .002 inch) (clearance between piston O. D. and cylinder) minus 0.02 mm which is the boring margin.

(3) Bore all cylinders to calculated boring finish dimension. Then bore the final finish dimension (piston O. D. plus cylinder clearance).

(4) Check clearance between piston and cylinder; clearance should be 0.02 to 0.04 mm (0.0008 to 0.0016 inch).

### PISTON—FITTING

Measure approximately 2 mm (0.080 in.) above the bottom of the piston skirt and across the thrust face (Fig. 16). Refer to Cylinder Boring.



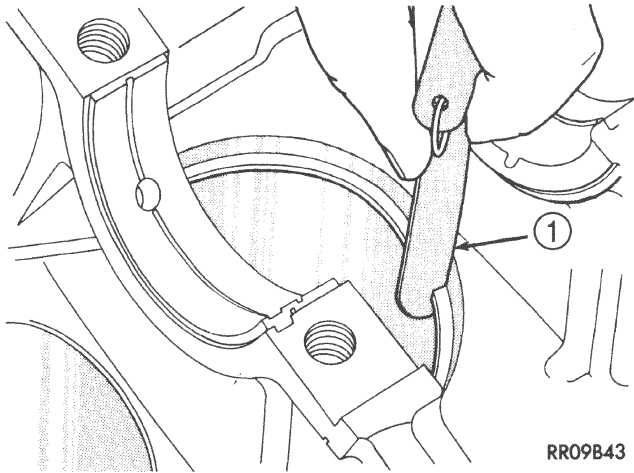
**Fig. 16 Measuring Piston for Clearance and Wear**

### PISTON RING—FITTING

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 16 mm (0.63 in.) from bottom of

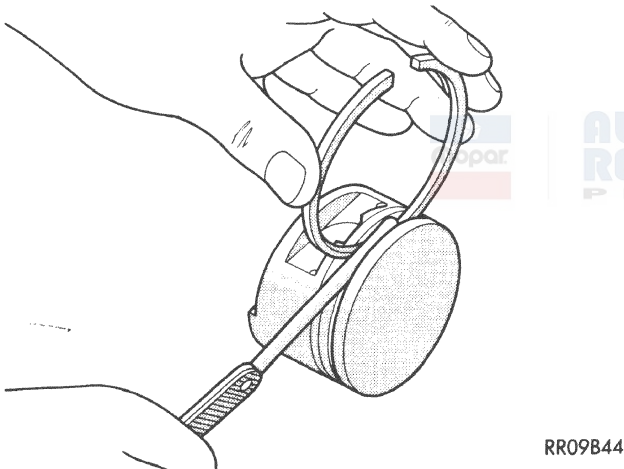
## SERVICE PROCEDURES (Continued)

cylinder bore. Check gap with feeler gauge (Fig. 17). Refer to Engine Specifications.



**Fig. 17 Check Gap on Piston Rings**

1 - FEELER GAUGE



**Fig. 18 Piston Ring Groove Clearance**

(2) Check piston ring to groove clearance (Fig. 18). Refer to Engine Specifications.

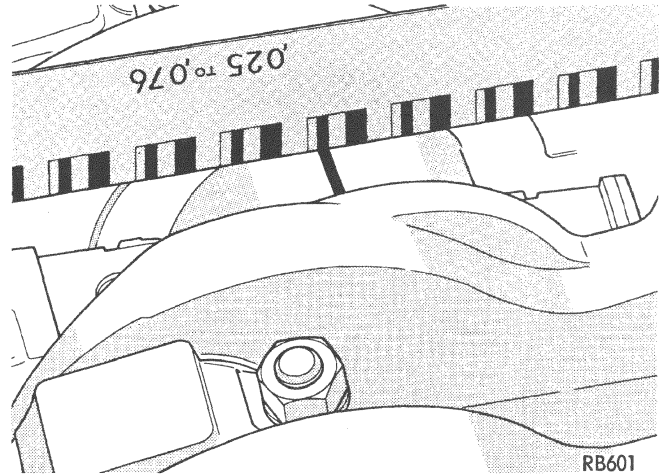
## CONNECTING ROD—FITTING

(1) Follow the procedures in the Standard Service Procedures Section for Measuring Main Bearing and Connecting Rod Bearing Clearances. (Fig. 19). Refer to Engine Specifications.

(2) Tighten connecting rod nuts to 51 N·m (37 ft. lbs.).

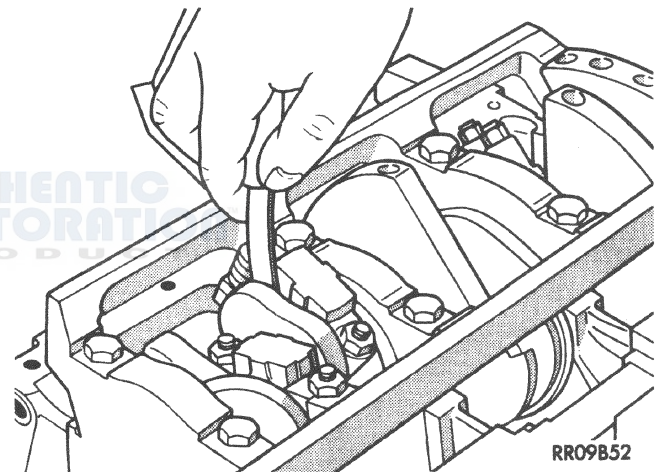
(3) Remove connecting rod cap and measure Plastigage (Fig. 19). Refer to Engine Specifications

**CAUTION:** Do not rotate crankshaft or the Plastigage may be smeared.



**Fig. 19 Checking Connecting Rod Bearing Clearance**

## CONNECTING ROD SIDE CLEARANCE



**Fig. 20 Checking Connecting Rod Side Clearance**

Using a feeler gauge, check connecting rod side clearance (Fig. 20). Refer to Engine Specifications.

## CRANKSHAFT MAIN BEARING—FITTING

### MAIN BEARING JOURNAL MEASUREMENT

Measure the journal outside diameter (Fig. 21). If the clearance exceeds the specifications limit, replace the main bearing(s), and if necessary, replace the crankshaft. Refer to Engine Specifications.

### PLASTIGAGE MEASUREMENT

(1) Remove oil from journal and bearing shell.

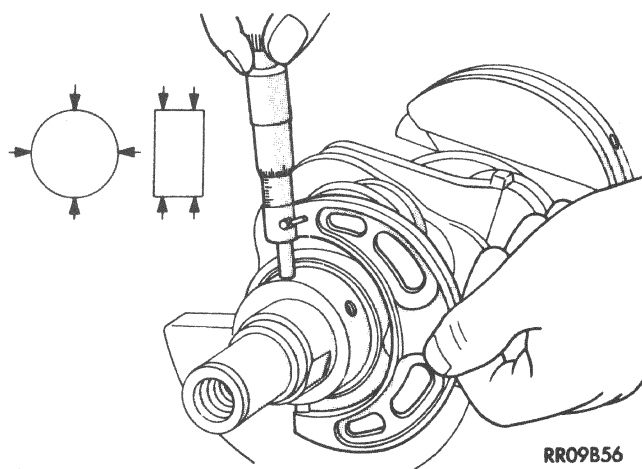
(2) Install crankshaft.

(3) Cut plastigage to same length as width of the bearing and place it in parallel with the journal axis (Fig. 22).

(4) Install the main bearing cap carefully and tighten the bolts to specified torque.

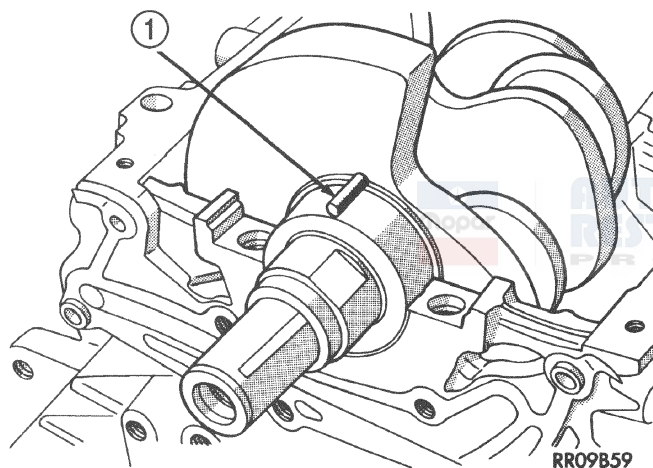


## SERVICE PROCEDURES (Continued)



**Fig. 21 Measure Crankshaft Journal O. D.**

**CAUTION:** Do not rotate crankshaft or the plasti-gage will be smeared.



**Fig. 22 Measure Oil Clearance with Plastigage**

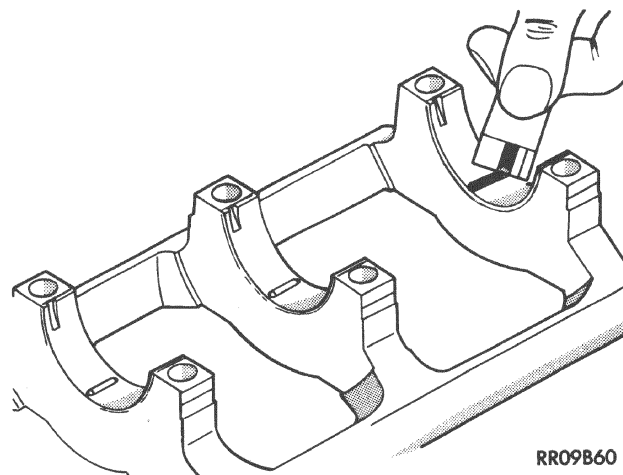
1 - PLASTIC GAUGE

(5) Carefully remove the bearing cap and measure the width of the plastigage at the widest part using the scale on the plastigage package (Fig. 23). Refer to Engine Specifications for proper clearance. Also see Measuring Main and Connecting Rod Bearing Clearances in Standard Service Procedures.

## CRANKSHAFT BEARING INSTALLATION

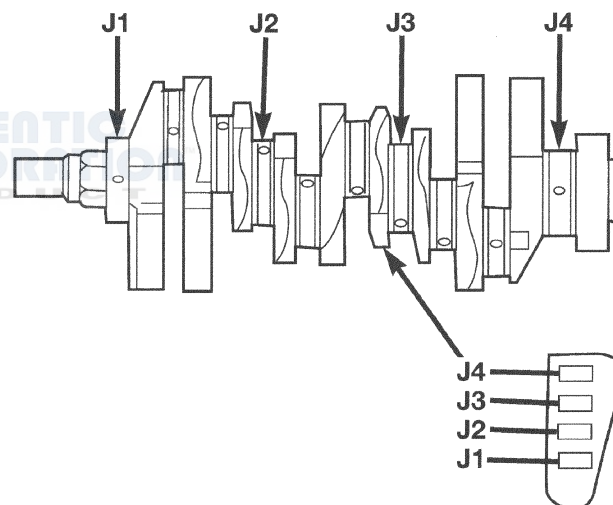
When replacing the bearings, select and install the proper bearing by using the following procedure.

(1) Measure the crankshaft journal diameter and confirm its classification from the Main Journal Size Identification Chart. In the case of a bearing supplied as a service part, the identification is embossed at the position shown in (Fig. 25).



**Fig. 23 Measuring Clearance**

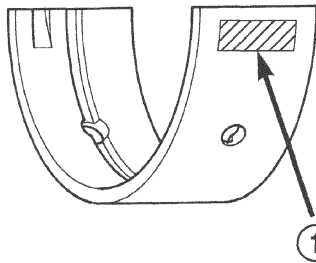
**NOTE:** Service Replacement parts have identification marks, but factory-assembled parts have no identification marks. Service crankshaft identification will have marks at counterweights (Fig. 24).



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**Fig. 24 Crankshaft Size Identification**

MAIN JOURNAL SIZE IDENTIFICATION	
SERVICE PART MARKING (Fig. 25)	JOURNAL OUTER DIAMETER
0	59.994–60.000 mm (2.3620–2.3622 in.)
1	59.988–59.994 mm (2.3617–2.3620 in.)
2	59.982–59.988 mm (2.3615–2.3617 in.)

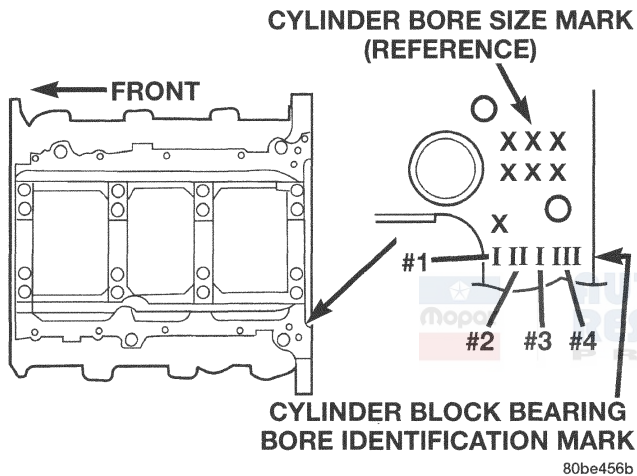
**SERVICE PROCEDURES (Continued)**

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**Fig. 25 Bearing Identification**

1 - IDENTIFICATION MARK

(2) The identification mark for the diameter of the cylinder block bearing bore is embossed as shown in (Fig. 26), starting from the # 1 mark at the front of the engine.



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**Fig. 26 Cylinder Block Bearing Bore Markings**

(3) Select and install the bearings according to these marks. Using the chart below, select the proper bearing by using the markings on the crankshaft and block. For a example:

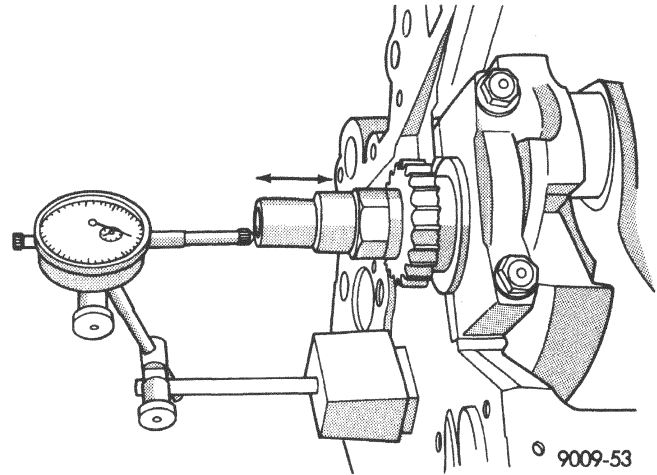
(a) If the crankshaft journal outer diameter is 60.000 mm (2.3622 in.), the service part classification will be "0" and the identification mark will be "0".

(b) If the identification mark for the cylinder block main bore is "II", select the bearing "2" according the chart below.

		Block Identification Mark		
		I	II	III
Main Journal Identification Mark	0	1	2	3
	1	2	3	4
	2	3	4	5

**CRANKSHAFT END PLAY**

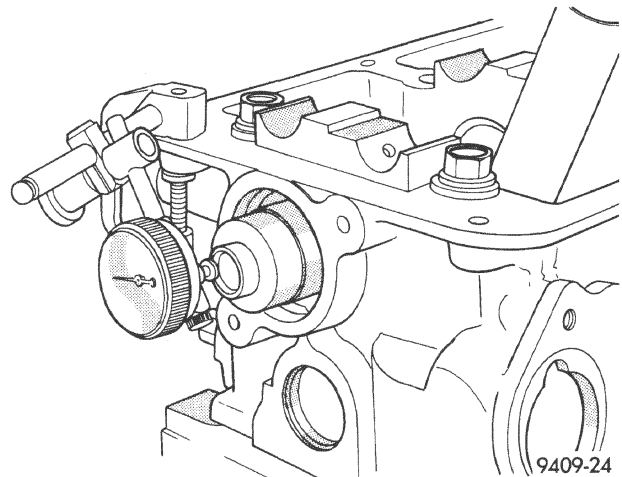
- (1) Mount a dial indicator to front of engine, locating probe on nose of crankshaft (Fig. 27).
- (2) Move crankshaft all the way to the rear of its travel.
- (3) Zero the dial indicator.

**Fig. 27 Crankshaft End Play—Typical**

- (4) Move crankshaft all the way to the front and read the dial indicator. Refer to Engine Specifications.

**CAMSHAFT END PLAY**

- (1) Oil camshaft journals and install camshaft without rocker arm assemblies.
- (2) Using a suitable tool, move camshaft as far rearward as it will go.
- (3) Zero dial indicator (Fig. 28).
- (4) Move camshaft as far forward as it will go.
- (5) End play travel: 0.1 - 0.2 mm (0.004 - 0.008 in.). Max. Travel: 0.4 mm (0.016 in.).

**Fig. 28 Camshaft End Play**



## REMOVAL AND INSTALLATION

### ENGINE MOUNTS—FRONT AND REAR

#### REMOVAL

##### FRONT MOUNT

- (1) Raise vehicle on hoist.
- (2) Remove through bolt (A) at front mount (Fig. 30).
- (3) Remove attaching bolts from mount to lower radiator support crossmember.

**NOTE:** It may be necessary to tilt engine for front mount removal clearance.

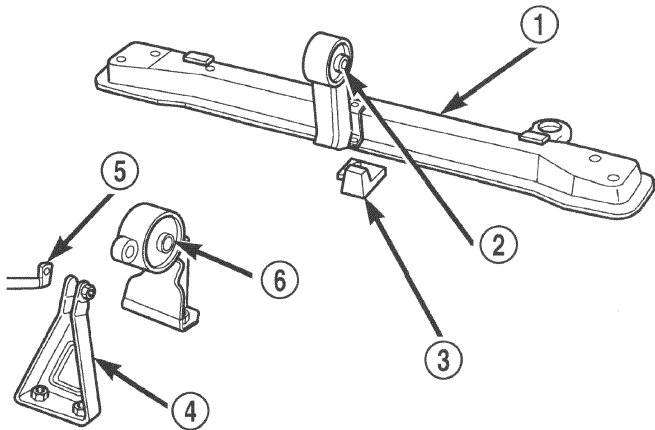
- (4) Remove front mount.

##### REAR MOUNT

- (1) Raise vehicle on hoist.
- (2) Remove through bolt (A) from rear engine mount and bracket (Fig. 31).
- (3) Remove rear strut bracket (Fig. 29).
- (4) Remove bolts attaching rear mount to crossmember.

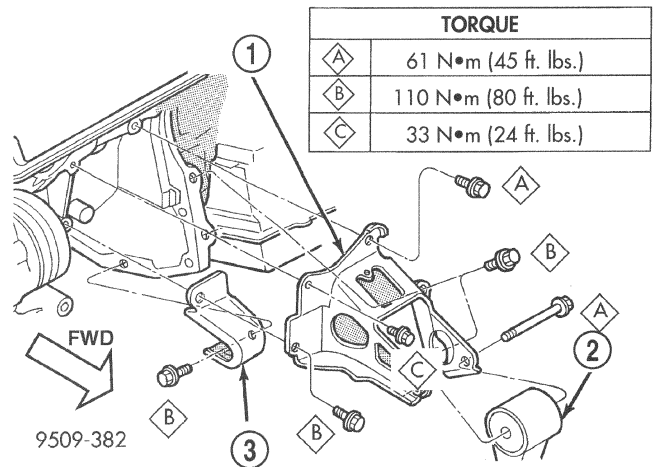
**NOTE:** It may be necessary to tilt engine for rear mount removal clearance.

- (5) Remove rear mount.



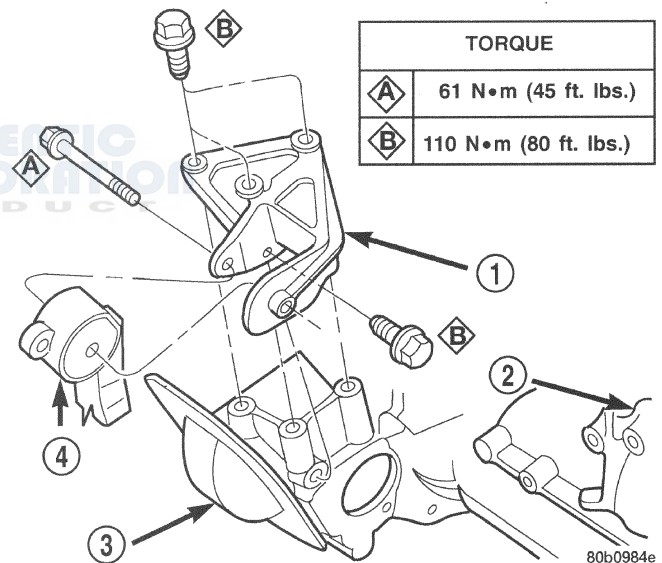
**Fig. 29 Engine Mounting—Front and Rear**

- 1 - LOWER RADIATOR SUPPORT
- 2 - FRONT ENGINE MOUNT
- 3 - DAMPER WEIGHT (SOME MODELS)
- 4 - REAR STRUT BRACKET
- 5 - SUPPORT BRACKET (SOME MODELS)
- 6 - REAR ENGINE MOUNT



**Fig. 30 Engine Mounting—Front 2.5L**

- 1 - FRONT TORQUE BRACKET
- 2 - SUPPORT
- 3 - STRUT



**Fig. 31 Engine Mounting—Rear 2.5L**

- 1 - REAR TORQUE BRACKET
- 2 - ENGINE
- 3 - TRANSMISSION
- 4 - REAR MOUNT

## INSTALLATION

### FRONT MOUNT

- (1) Position front mount. Install front mount to lower radiator support crossmember attaching bolts. Tighten bolts to 61 N•m (45 ft. lbs.).
- (2) Install through bolt (A) (Fig. 30).
- (3) Tighten front through bolt (A) to 61 N•m (45 ft. lbs.) (Fig. 30).
- (4) Lower vehicle.

**REMOVAL AND INSTALLATION (Continued)****REAR MOUNT**

- (1) Position rear mount.
- (2) Install bolts attaching rear mount to suspension crossmember. Tighten bolts to 61 N·m (45 ft. lbs.).
- (3) Install rear strut bracket (Fig. 29). Tighten bolts to 61 N·m (45 ft. lbs.).
- (4) Install through bolt (A) and tighten 61 N·m (45 ft. lbs.) (Fig. 31).
- (5) Lower vehicle

**ENGINE MOUNT—RIGHT/ENGINE SUPPORT BRACKET**

**NOTE:** The right side engine mount is a Hydro-Mount and may show surface cracks. This will not effect it's performance and should not be replaced. Only replace the Hydro-Mount when it's leaking fluid.

- (1) Raise vehicle on a hoist and remove inner splash. Remove the right engine support assembly vertical fasteners from frame rail (Fig. 32).
- (2) Lower vehicle. Remove the load on the engine motor mounts by carefully supporting the engine assembly with a floor jack.
- (3) Remove the three bolts attaching the engine support assembly to the engine bracket.
- (4) Move the air conditioning dryer aside.
- (5) Remove coolant recovery system tank. Refer to Group 7, Cooling System for procedure.
- (6) Remove right engine support.
- (7) Remove the three bolts attaching the engine support bracket to the cylinder block.

**NOTE:** If centering or adjusting the engine/transmission assembly is needed refer to **Adjustments**, in this section.

- (8) Reverse removal procedure for installation. Refer to (Fig. 32) for bolt tightening specifications.

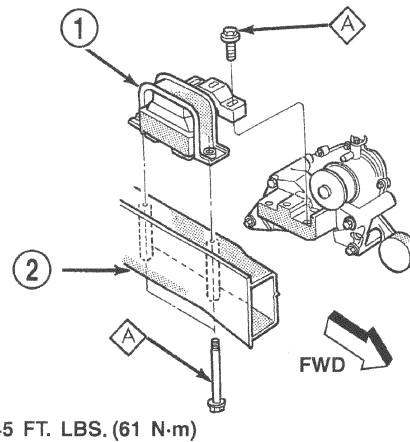
**ENGINE MOUNT—LEFT**

**NOTE:** If centering or adjusting the engine/transmission assembly is needed refer to **Adjustments**, in this section.

The left side engine mount is a Hydro-Mount and may show surface cracks. This will not effect it's performance and should not be replaced. Only replace the Hydro-Mount when it's leaking fluid.

**REMOVAL**

- (1) Support the transmission with a transmission jack.



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**Fig. 32 Engine Mounting—Right Side 2.5L**

- 1 – RIGHT ENGINE SUPPORT ASSEMBLY  
2 – FRAME RAIL

- (2) Remove the three vertical bolts (A) from the mount to the transmission bracket (Fig. 33).
- (3) Remove the mount to frame rail fasteners (B) and remove mount (Fig. 33).

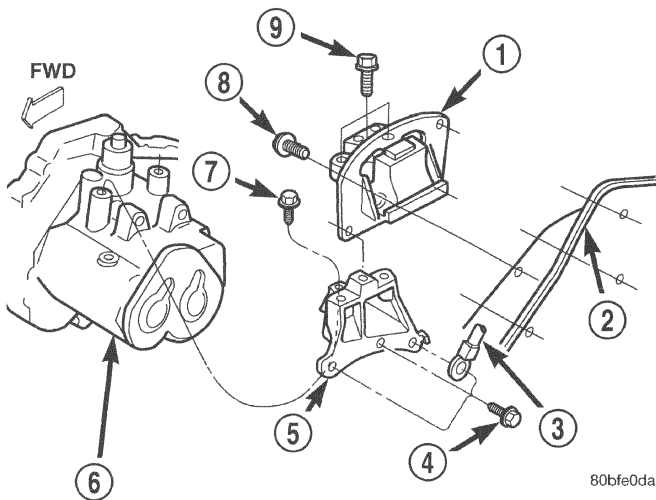
**INSTALLATION**

- (1) Install mount. Tighten mount to frame rail fasteners (B) to 33 N·m (24 ft. lbs.) (Fig. 33).
- (2) If removed, install transmission bracket and tighten bolts (C) and (D) to 61 N·m (45 ft. lbs.) (Fig. 33).
- (3) Install mount to transmission bracket vertical bolts (A). Tighten to 61 N·m (45 ft. lbs.) (Fig. 33).

**ENGINE ASSEMBLY****REMOVAL**

- (1) Perform fuel pressure release procedure. Refer to Group 14, Fuel System for procedure. Remove fuel line to fuel rail.
- (2) Disconnect negative cable from battery remote jumper terminal.
- (3) Remove Powertrain Control Module (PCM) attaching screws and set aside.
- (4) Drain cooling system. Refer to Group 7, Cooling System for procedure.
- (5) Remove upper radiator hose, radiator and fan module. Refer to Group 7, Cooling System for procedure.
- (6) Remove lower radiator hose.
- (7) Disconnect automatic transaxle cooler lines and plug.
- (8) Disconnect transaxle shift linkage.
- (9) Disconnect throttle body linkage.
- (10) Disconnect engine wiring harness.
- (11) Disconnect heater hoses.

## REMOVAL AND INSTALLATION (Continued)

**Fig. 33 Left Side Mount—Typical**

- 1 - TRANSMISSION SUPPORT ASSEMBLY
- 2 - LEFT FRAME RAIL
- 3 - GROUND CABLE
- 4 - BOLT (D)
- 5 - TRANSMISSION BRACKET
- 6 - TRANSMISSION
- 7 - BOLT (C)
- 8 - BOLT (B)
- 9 - BOLT (A)

(12) Remove refrigerant from air conditioning system using a refrigerant recovery machine. Refer to Group 24, Air Conditioning for procedure.

(13) Hoist vehicle and remove right inner splash shield.

(14) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

(15) Remove axle shafts. Refer to Group 2, Suspension and Driveshaft for procedure.

(16) Disconnect exhaust pipe from manifold.

(17) Remove front and rear engine mount through bolts.

(18) Lower vehicle. Remove air cleaner assembly.

(19) Remove power steering pump and reservoir and set them aside.

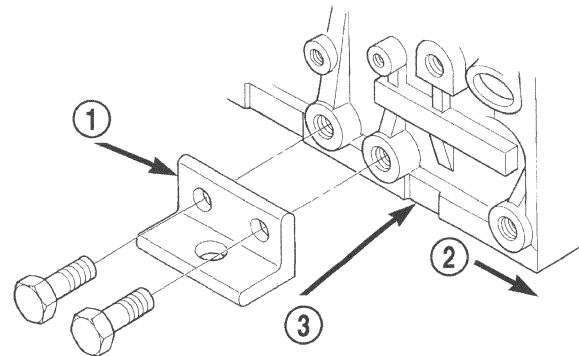
(20) Remove A/C compressor.

(21) Remove ground straps to body.

(22) Mount Special Tool 6973 bracket, to the right side of the cylinder block (Fig. 34). Align the front adjustable post with the hole in the bracket.

(23) Raise vehicle enough to allow engine dolly and cradle Special Tools 6135 and 6710 to be installed under vehicle (Fig. 35).

(24) Loosen cradle engine mounts to allow movement for positioning onto engine locating holes on the engine bedplate. Lower vehicle and position cradle mounts until the engine is resting on mounts. Tighten mounts to cradle frame. This will keep mounts from



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**Fig. 34 Bracket for Cradle Post Support**

- 1 - SPECIAL TOOL 6973
- 2 - FRONT OF ENGINE
- 3 - OIL PAN MATTING SURFACE

moving when removing or installing engine and transaxle.

(25) Lower vehicle so weight of the engine and transaxle ONLY is on the cradle.

(26) Remove engine and transaxle mount bolts.

(27) Raise vehicle slowly. It may be necessary to move the engine/transaxle assembly on the cradle to allow for removal around body flanges.

**INSTALLATION**

(1) Position engine/transaxle assembly under vehicle and slowly lower the vehicle.

(2) Align engine and transaxle mounts to attaching points. Install mounting bolts at the right engine and left transaxle mounts. Refer to procedures in this section.

(3) Slowly raise vehicle enough to remove the engine dolly and cradle Special Tools 6135 and 6710.

(4) Remove Special Tool 6973 bracket from engine.

(5) Install axle shafts. Refer to Group 2, Suspension and Driveshaft for procedure.

(6) Install transaxle and engine braces.

(7) Connect exhaust system to manifold.

(8) Install power steering pump and reservoir. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

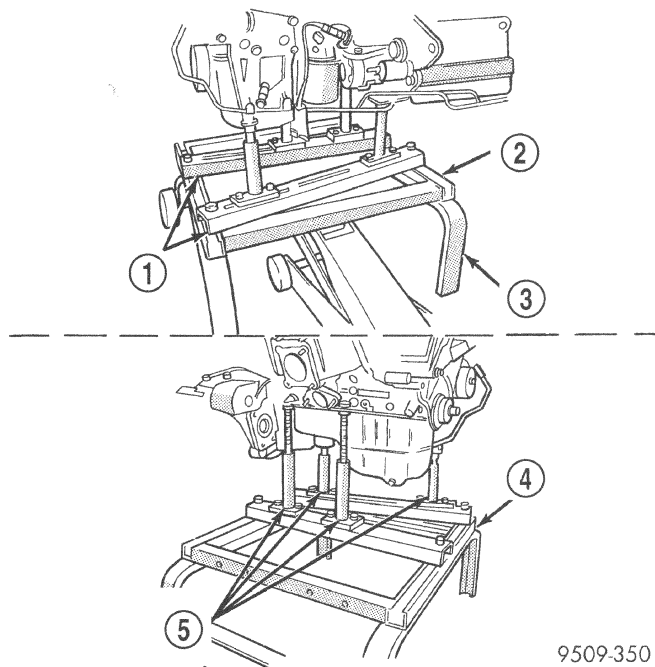
(9) Install A/C compressor and hoses. Refer to Group 24, Heater and Air Conditioning for procedure.

(10) Install accessory drive belts. Refer to Group 7, Cooling System Accessory Drive Section for belt tension adjustment.

(11) Install front and rear engine mounts. Refer to procedure in this section.

(12) Install inner splash shield. Install wheels and tires.



**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 35 Positioning Engine Cradle Support Post Mounts**

- 1 - SPECIAL TOOL SUPPORT BARS NO. 6810-3A
- 2 - SPECIAL TOOL ENGINE CRADLE NO. 6810
- 3 - SPECIAL TOOL ENGINE DOLLY NO. 6135
- 4 - SPECIAL TOOL ENGINE CRADLE NO. 6810
- 5 - SPECIAL TOOL ADJUSTABLE POSTS NO. 6848

(13) Connect automatic transaxle cooler lines and shifter linkage. Refer to Group 21, Transaxle for procedures.

(14) Connect fuel line and heater hoses.

(15) Install ground straps. Connect engine and throttle body connections and wiring harnesses. Refer to Group 8, Electrical for procedure.

(16) Connect throttle body linkage. Refer to Group 14, Fuel System for procedure.

(17) Install radiator and shroud assembly. Install radiator hoses. Fill cooling system. See Group 7, Cooling System for filling procedure.

(18) Connect battery.

(19) Install Powertrain Control Module (PCM).

(20) Install air cleaner and hoses.

(21) Install oil filter. Fill engine crankcase with proper oil to correct level.

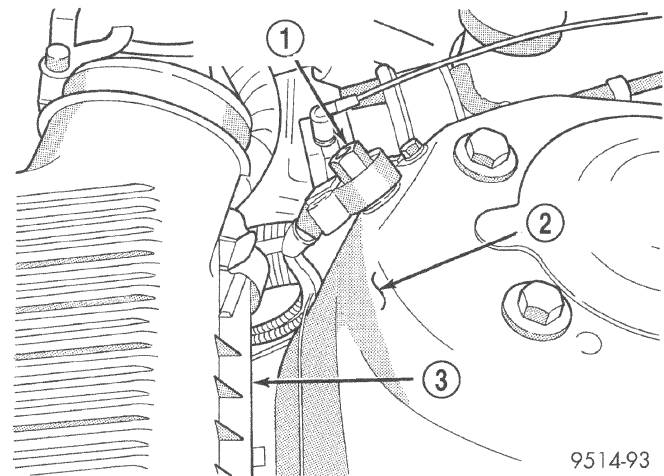
(22) Evacuate and charge air conditioning system. Refer to Group 24, Heating and Air Conditioning for procedures.

(23) Start engine and run until operating temperature is reached.

(24) Adjust transaxle linkage, if necessary.

**INTAKE MANIFOLD—UPPER****REMOVAL**

(1) Disconnect negative cable from auxiliary jumper terminal (Fig. 36).



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**Fig. 36 Auxiliary Jumper Terminal**

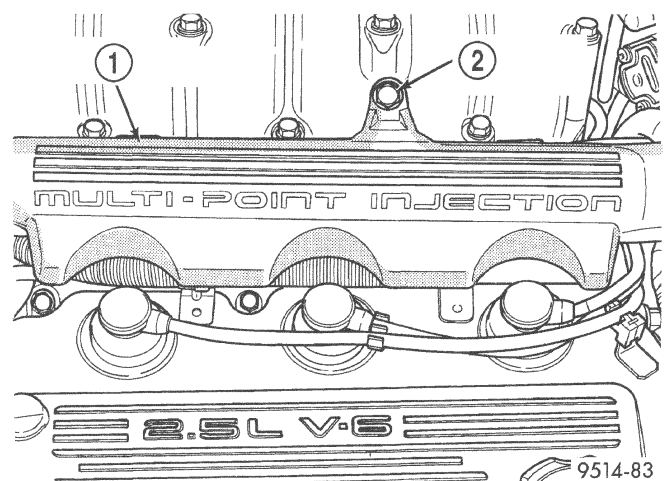
- 1 - AUXILIARY JUMPER TERMINAL
- 2 - LEFT STRUT TOWER
- 3 - AIR CLEANER HOUSING

(2) Remove bolt holding air inlet resonator to intake manifold (Fig. 37).

(3) Loosen throttle body air inlet hose clamp.

(4) Release snaps holding air cleaner housing cover to housing.

(5) Remove air cleaner cover and inlet hoses from engine.



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**Fig. 37 Air Inlet Resonator**

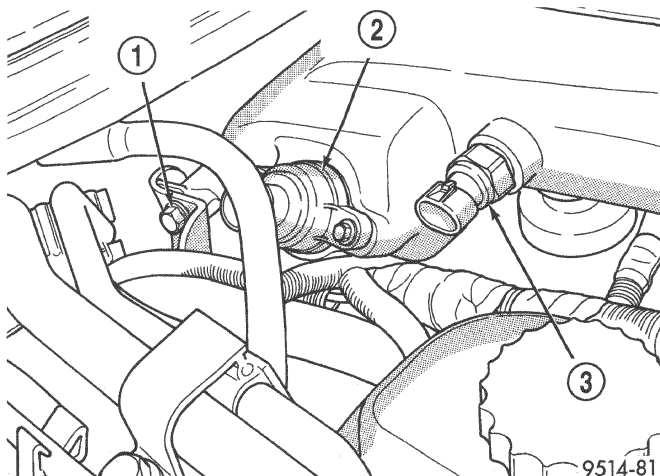
- 1 - AIR INLET RESONATOR
- 2 - RESONATOR BOLT

(6) Disconnect connectors from MAP and intake air temperature sensors (Fig. 38).



**REMOVAL AND INSTALLATION (Continued)**

(7) Remove manifold support bracket bolt located rearward of MAP sensor (Fig. 38).



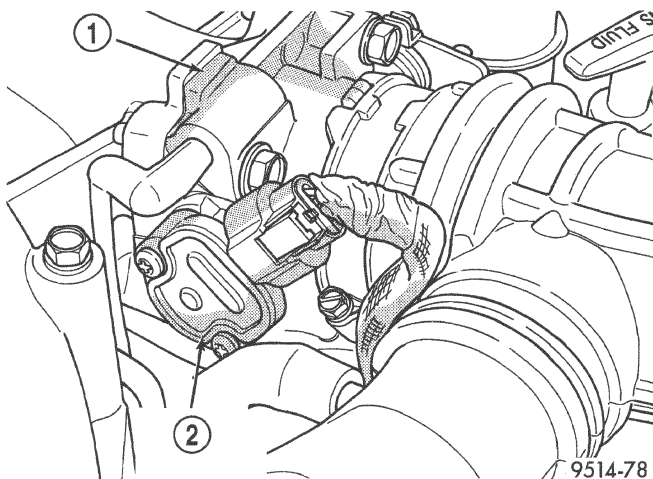
**Fig. 38 Intake Manifold Sensors and Left Manifold Support Bolt**

- 1 - SUPPORT BRACKET BOLT
- 2 - MAP SENSOR
- 3 - INTAKE AIR TEMPERATURE SENSOR

(8) Disconnect TPS and idle air control motor connectors (Fig. 39) and (Fig. 40).

(9) Disconnect brake booster hose.

(10) Disconnect purge hose from throttle body.



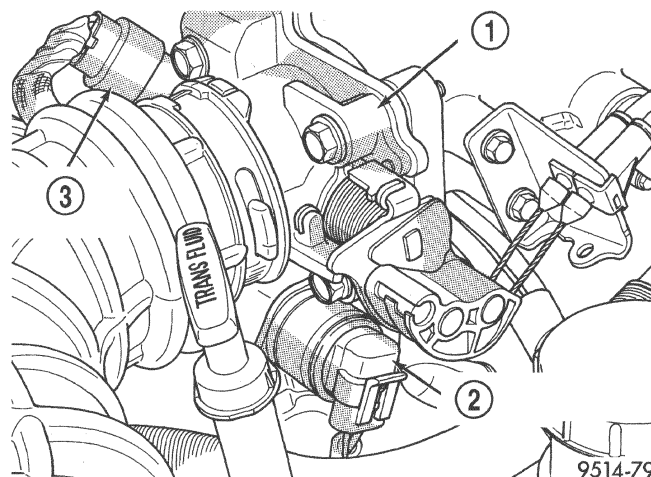
**Fig. 39 Throttle Position Sensor**

- 1 - THROTTLE BODY
- 2 - THROTTLE POSITION SENSOR

(11) Squeeze retainer tab on throttle cable and slide cable out of bracket (Fig. 41).

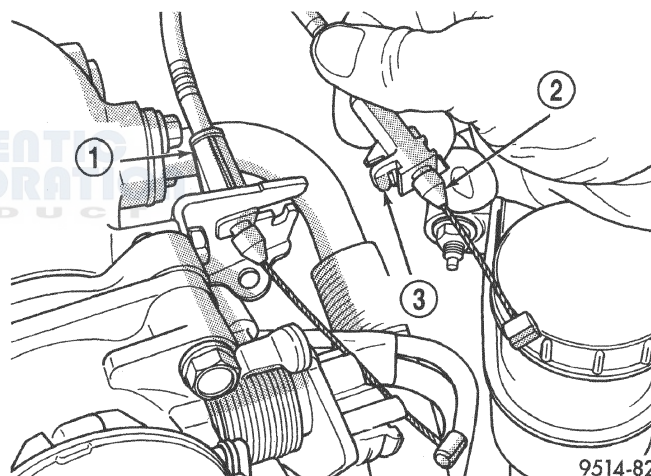
(12) Slide speed control cable out of bracket, if equipped (Fig. 41).

(13) Remove EGR tube from intake manifold and discard gasket (Fig. 42).



**Fig. 40 Idle Air Control Motor**

- 1 - THROTTLE BODY
- 2 - IDLE AIR CONTROL MOTOR
- 3 - THROTTLE POSITION SENSOR

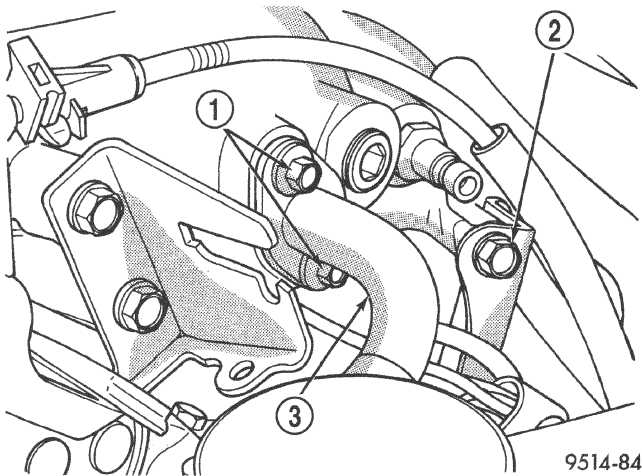


**Fig. 41 Throttle Cable Attachment**

- 1 - SPEED CONTROL CABLE
- 2 - THROTTLE CABLE
- 3 - RELEASE TANG

(14) Remove manifold support bracket bolt located rearward of EGR tube (Fig. 42).

(15) Remove bolts holding upper intake manifold and remove manifold (Fig. 43).

**REMOVAL AND INSTALLATION (Continued)****Fig. 42 EGR Tube and Right Manifold Support Bolt**

- 1 - EGR TUBE BOLTS
- 2 - SUPPORT BRACKET BOLT
- 3 - EGR TUBE

**INSTALLATION**

(1) Install new gasket and position upper intake manifold to lower manifold. Install manifold bolts and tighten to 18 N·m (13 ft. lbs.) (Fig. 43).

(2) Install bolts at manifold support brackets. Tighten bolts to 18 N·m (13 ft. lbs.).

(3) Install EGR tube with new gasket to plenum. Tighten EGR tube to intake manifold plenum screws to 11 N·m (95 in. lbs.).

(4) Install throttle and speed control cables.

(5) Connect brake booster hose.

(6) Connect purge hose to throttle body.

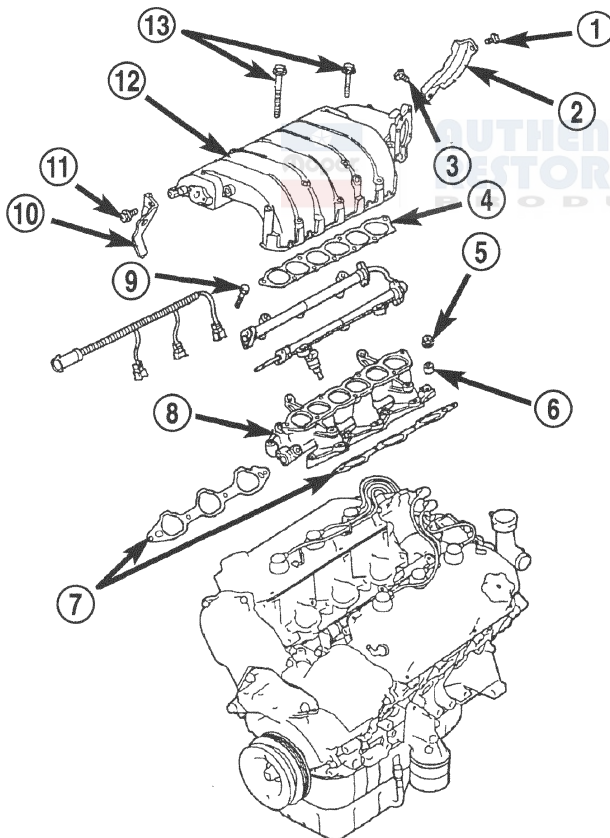
(7) Attach electrical connectors to sensors.

(8) Install air cleaner cover and inlet hoses.

(9) Tighten air inlet tube clamps to 3 N·m  $\pm$  1 (25 in. lbs.  $\pm$  5).

(10) Install bolt holding air inlet resonator to intake manifold (Fig. 37).

(11) Connect negative cable to auxiliary jumper terminal (Fig. 36).

**Fig. 43 Intake Manifolds**

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- 1 - 18 N·m (13 ft. lbs.)
- 2 - LEFT SIDE MANIFOLD SUPPORT
- 3 - 36 N·m (26 ft. lbs.)
- 4 - GASKET
- 5 - NUT
- 6 - SPRING WASHER
- 7 - LOWER INTAKE MANIFOLD GASKETS

- 8 - LOWER INTAKE MANIFOLD
- 9 - 12 N·m (8 ft. lbs.)
- 10 - RIGHT SIDE MANIFOLD SUPPORT
- 11 - 18 N·m (13 ft. lbs.)
- 12 - UPPER INTAKE MANIFOLD
- 13 - 18 N·m (13 ft. lbs.)



## REMOVAL AND INSTALLATION (Continued)

### INTAKE MANIFOLD—LOWER

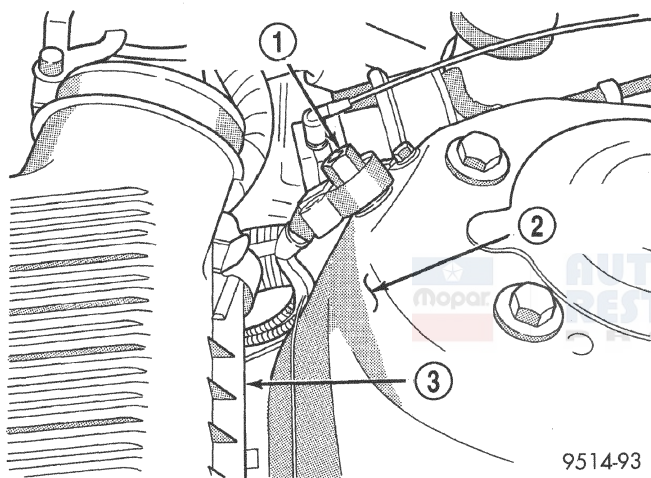
#### REMOVAL

(1) Disconnect negative cable from auxiliary jumper terminal (Fig. 44).

**WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.**

(2) Release fuel system pressure. Refer to Group 14, Fuel System for procedure.

**WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.**



**Fig. 44 Auxiliary Jumper Terminal**

- 1 - AUXILIARY JUMPER TERMINAL
- 2 - LEFT STRUT TOWER
- 3 - AIR CLEANER HOUSING

(3) Disconnect fuel supply tube from rail. Refer to Group 14, Fuel System for procedure.

(4) Remove upper intake manifold. Refer to procedure in this section.

(5) Disconnect electrical connectors from fuel injectors.

(6) Remove bolts holding fuel rail (Fig. 45).

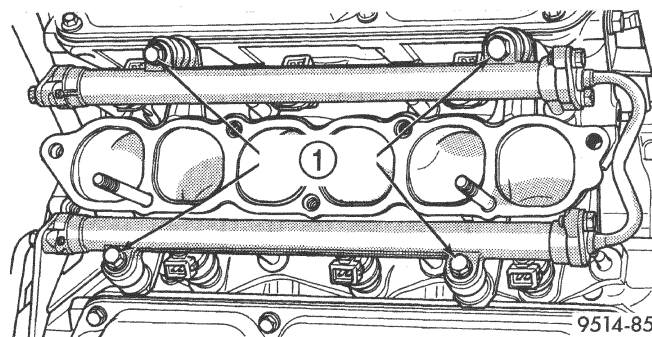
(7) Lift fuel rail off engine. **There are spacers under each fuel rail bolt (Fig. 46).**

(8) Remove lower intake manifold attaching bolts. Remove intake manifold (Fig. 47).

#### INSTALLATION

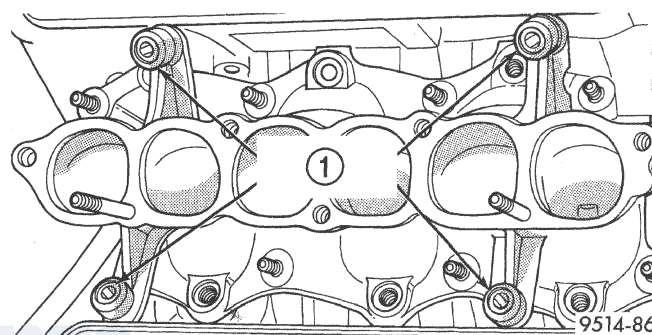
(1) Install new intake manifold gaskets (Fig. 47).

(2) Install intake manifold, spring washers and nuts (Fig. 47).



**Fig. 45 Fuel Rail Attachment**

- 1 - FUEL RAIL BOLTS



**Fig. 46 Fuel Rail Spacers**

- 1 - FUEL RAIL SPACERS

(3) Tighten the intake manifold mounting nuts (Fig. 48) one bank after the other by using the following procedures:

- Tighten nuts "R" to 6.4 N·m (56 in. lbs.)
- Tighten nuts "L" to 21 N·m (185 in. lbs.)
- Tighten nuts "R" to 21 N·m (185 in. lbs.)
- Tighten nuts "L" again to 21 N·m (185 in. lbs.)
- Tighten nuts "R" again to 21 N·m (185 in. lbs.)

(4) Apply a light coating of clean engine oil to the O-ring on the nozzle end of each injector.

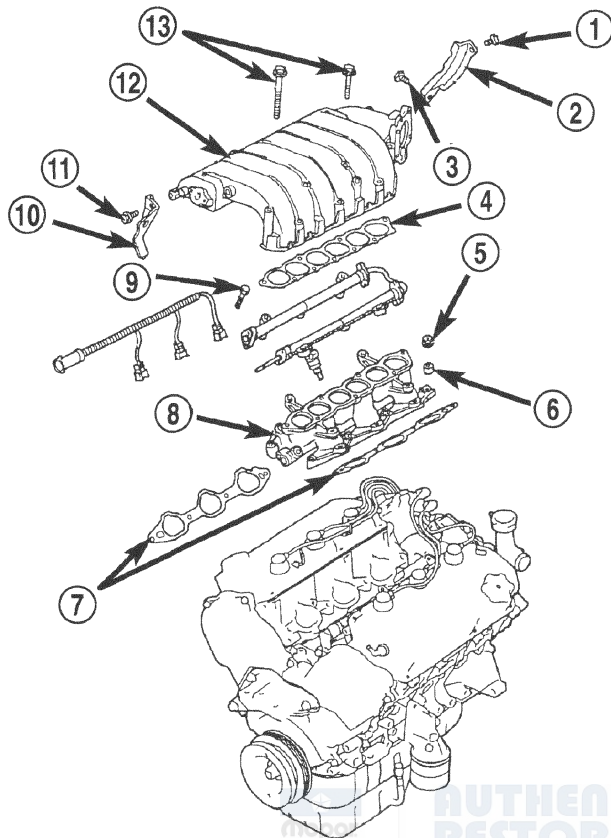
(5) Insert fuel injector nozzles into openings in intake manifold. Seat the injectors in place. Tighten fuel rail bolts to 12 N·m (8 ft. lbs.).

(6) Attach electrical connectors to fuel injectors.

(7) Connect fuel supply tube to fuel rail. Refer to Group 14, Fuel System for procedure.

(8) Install upper intake manifold. Refer to procedure in this section.

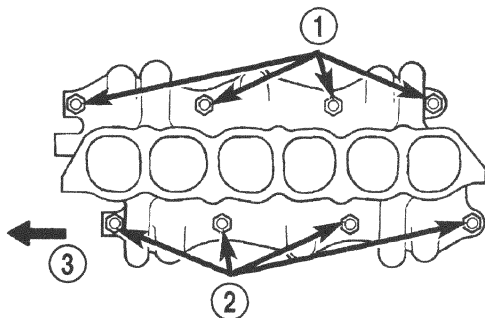
(9) Connect negative cable to auxiliary jumper terminal.

**REMOVAL AND INSTALLATION (Continued)****Fig. 47 Intake Manifolds**

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- 1 - 18 N•m (13 ft. lbs.)
- 2 - LEFT SIDE MANIFOLD SUPPORT
- 3 - 36 N•m (26 ft. lbs.)
- 4 - GASKET
- 5 - NUT
- 6 - SPRING WASHER
- 7 - LOWER INTAKE MANIFOLD GASKETS

- 8 - LOWER INTAKE MANIFOLD
- 9 - 12 N•m (8 ft. lbs.)
- 10 - RIGHT SIDE MANIFOLD SUPPORT
- 11 - 18 N•m (13 ft. lbs.)
- 12 - UPPER INTAKE MANIFOLD
- 13 - 18 N•m (13 ft. lbs.)



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**Fig. 48 Intake Manifold Tightening**

- 1 - NUT "R"
- 2 - NUT "L"
- 3 - TIMING BELT SIDE

**EXHAUST MANIFOLD****REMOVAL****REAR EXHAUST MANIFOLD**

(1) Raise vehicle and remove the entire exhaust system. Refer to Group 11, Exhaust System for procedure.

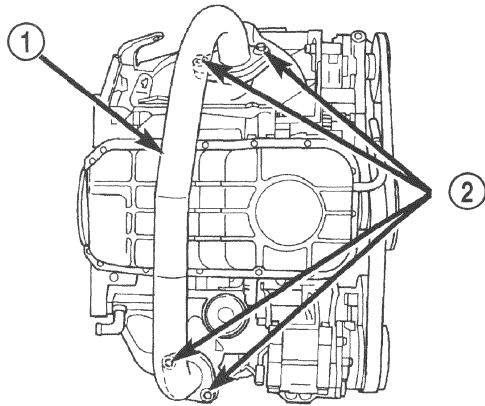
(2) Remove bolts attaching cross-under pipe to manifolds (Fig. 49). Remove assembly.

(3) Remove heat shield from rear exhaust manifold (Fig. 50).

(4) Remove power steering pump bracket. Refer to Group 19, Steering for procedure.

(5) Remove nuts attaching rear manifold to cylinder head and remove manifold (Fig. 51).



**REMOVAL AND INSTALLATION (Continued)**

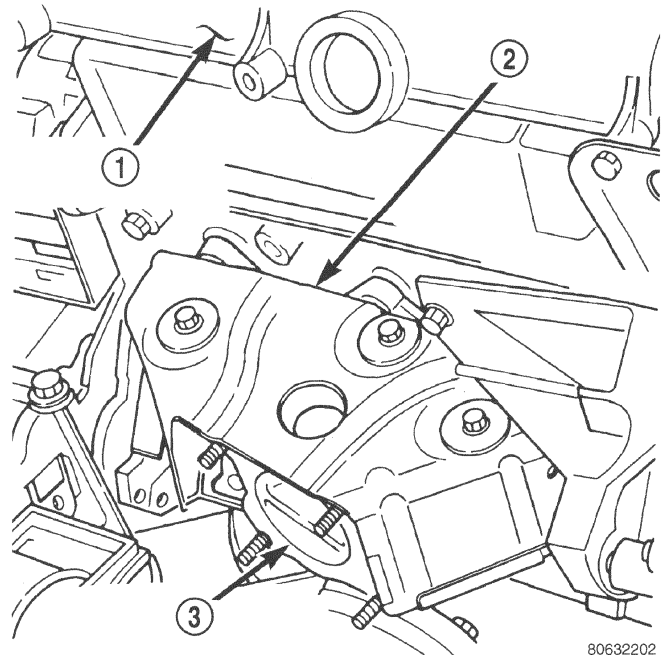
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**Fig. 49 Cross-Under Pipe Attaching Bolts**

- 1 - EXHAUST CROSS-UNDER PIPE  
2 - ATTACHING BOLTS

**FRONT EXHAUST MANIFOLD**

- (1) Remove cooling fan module. Refer to Group 7, Cooling System for procedure.
- (2) Raise vehicle and remove bolts attaching cross-under pipe to manifold (Fig. 49).
- (3) Remove oil dipstick tube.
- (4) Lower vehicle.
- (5) Remove generator support bracket.
- (6) Remove screws attaching front heat shield to manifold.

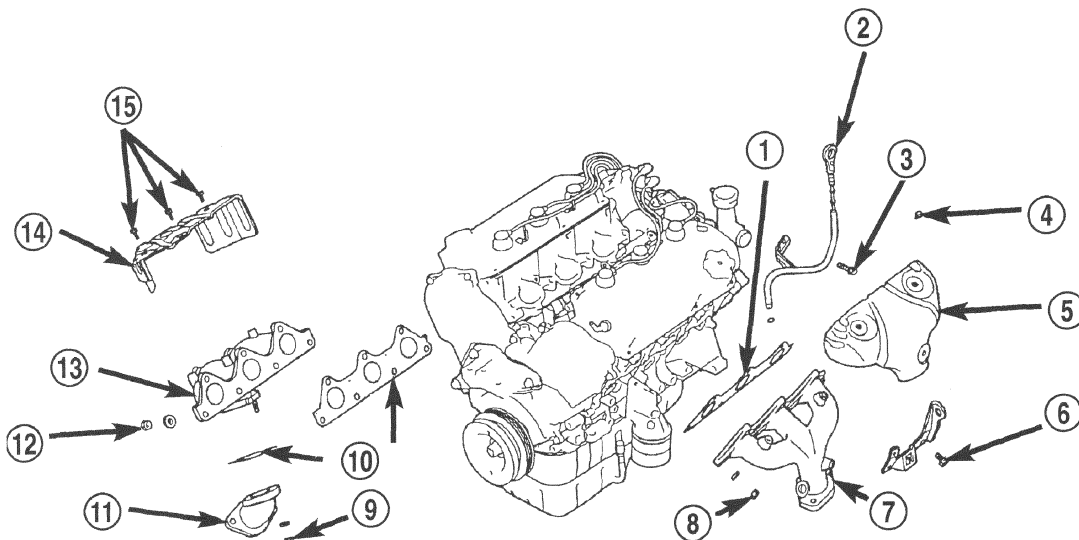


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**Fig. 50 Rear Exhaust Manifold Heat Shield**

- 1 - REAR OF INTAKE MANIFOLD  
2 - HEAT SHIELD  
3 - REAR EXHAUST MANIFOLD FLANGE

- (7) Remove front exhaust manifold attaching fasteners.
- (8) Remove front exhaust manifold (Fig. 51).



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**Fig. 51 Exhaust Manifolds**

- 1 - GASKET  
2 - OIL DIPSTICK AND TUBE  
3 - 23 N•m (17 ft. lbs.)  
4 - 13 N•m (10 ft. lbs.)  
5 - FRONT HEAT SHIELD  
6 - 36 N•m (26 ft. lbs.)  
7 - FRONT EXHAUST MANIFOLD  
8 - 30 N•m (22 ft. lbs.)

- 9 - NUT 59 N•m (43 ft. lbs.)  
10 - GASKETS  
11 - EXHAUST MANIFOLD  
12 - 30 N•m (22 ft. lbs.)  
13 - REAR EXHAUST MANIFOLD  
14 - REAR HEAT SHIELD  
15 - 13 N•m (10 ft. lbs.)

**REMOVAL AND INSTALLATION (Continued)****INSTALLATION****REAR EXHAUST MANIFOLD**

(1) Position new exhaust manifold gasket onto rear cylinder head.

(2) Install the rear exhaust manifold (Fig. 51) and tighten attaching nuts to 30 N·m (22 ft. lbs.).

(3) Install rear exhaust manifold heat shield and tighten fastener to 13 N·m (115 in. lbs.).

(4) Install power steering pump bracket to engine. Refer to Group 19, Steering for procedure.

(5) Install exhaust system. Refer to Group 11, Exhaust System for procedure.

(6) Attach cross-under pipe to exhaust manifold and tighten fasteners to 31 N·m (275 in. lbs.) (Fig. 49).

**FRONT EXHAUST MANIFOLD**

(1) Position new exhaust manifold gasket onto front cylinder head.

(2) Install front exhaust manifold (Fig. 51) and tighten attaching nuts to 30 N·m (22 ft. lbs.).

(3) Install front manifold heat shield and tighten attaching screws to 13 N·m (115 in. lbs.).

(4) Install generator support bracket.

(5) Install cooling fan module. Refer to Group 7, Cooling System for procedure.

(6) Raise vehicle.

(7) Install oil dipstick tube.

(8) Attach cross-under pipe to exhaust manifold and tighten fasteners to 31 N·m (275 in. lbs.) (Fig. 49).

**CYLINDER HEAD COVER****FRONT CYLINDER HEAD COVER****REMOVAL**

(1) Disconnect and relocate spark plug cables and wiring harness.

(2) Disconnect PCV and breather hoses.

(3) Remove cylinder head cover fasteners and remove cover (Fig. 52).

**INSTALLATION**

**NOTE:** Before installation, clean cylinder head and cover mating surfaces. Make certain the rails are flat.

(1) Clean cylinder head and cover mating surfaces. Install new gasket.

(2) Install cover and tighten cover bolt washer and gasket assembly to 10 N·m (88 in. lbs.).

(3) Connect PCV and breather hoses.

(4) Connect spark plug cables and wiring harness.

**REAR CYLINDER HEAD COVER****REMOVAL**

(1) Remove upper intake manifold. Refer to procedure in this section.

(2) Cover lower intake manifold with a suitable cover during service.

(3) Disconnect and relocate spark plug cables.

(4) Disconnect breather hose.

(5) Remove cylinder head cover fasteners and remove cover (Fig. 52).

**INSTALLATION**

**NOTE:** Before installation, clean cylinder head and cover mating surfaces. Make certain the rails are flat.

(1) Clean cylinder head and cover mating surfaces. Install new gasket.

(2) Install cover and tighten cover bolt washer and gasket assembly to 10 N·m (88 in. lbs.).

(3) Connect spark plug cables.

(4) Connect breather hose.

(5) Install upper intake manifold. Refer to procedure in this section.

**SPARK PLUG TUBE SEALS**

The spark plug tube seals are located on the end of each tube (Fig. 53). These seals slide onto each tube to seal the cylinder head cover to spark plug tube. If these seals show signs of hardness and/or cracks, they should be replaced.

**CYLINDER HEAD****REMOVAL**

(1) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(2) Raise vehicle and disconnect exhaust system from exhaust manifold.

(3) Remove timing belt and camshaft sprockets. Refer to procedures in this section.

(4) Remove upper and lower intake manifolds. Refer to procedures in this section.

(5) Remove distributor. Refer to Group 8D, Ignition System for procedure.

(6) Remove bolts attaching thermostat housing assembly to cylinder head.

(7) Remove cylinder head covers and rocker arm assemblies. Refer to procedures in this section.

(8) Remove cylinder head bolts and remove cylinder head(s).

(9) Remove exhaust manifold from cylinder head(s).

## REMOVAL AND INSTALLATION (Continued)

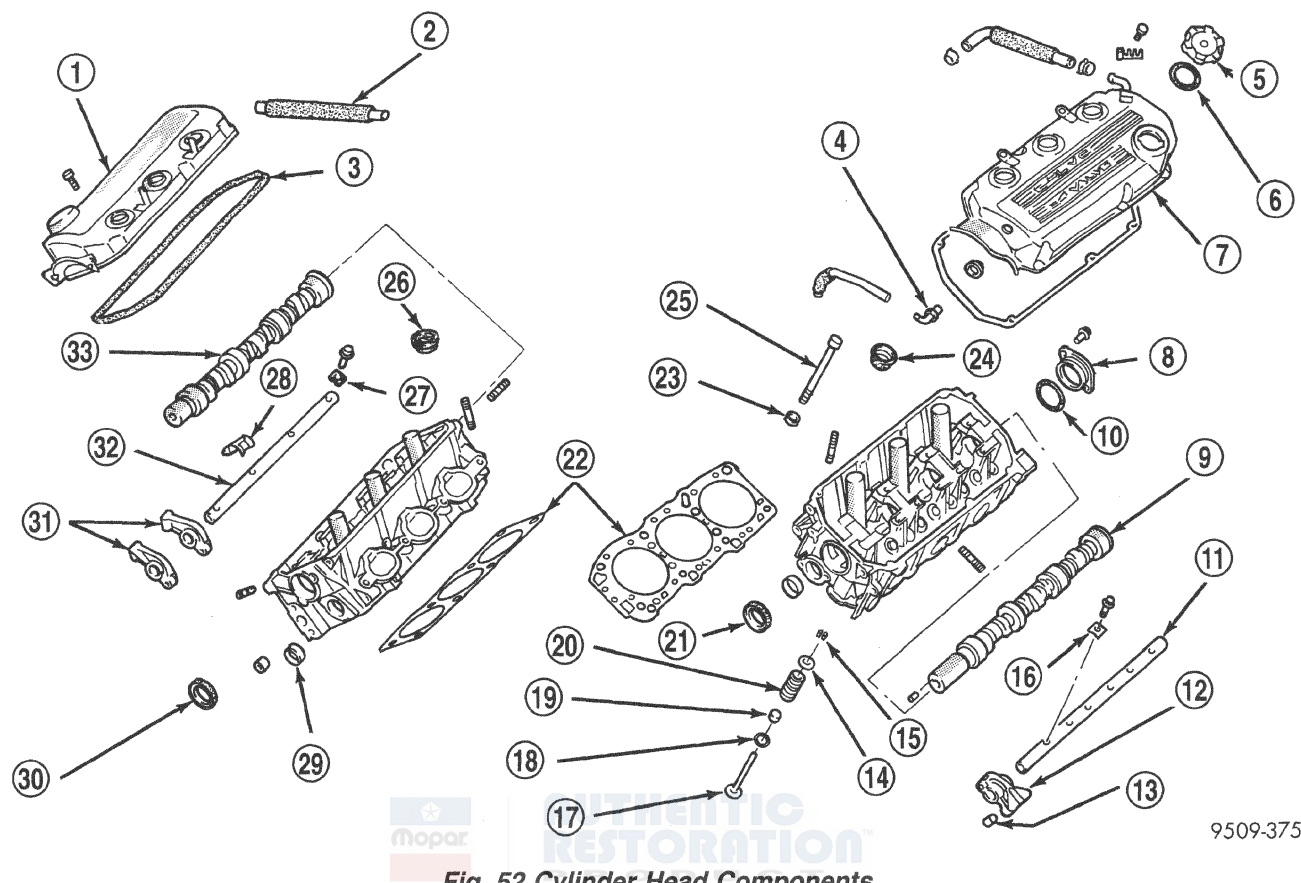


Fig. 52 Cylinder Head Components

- |                               |                              |
|-------------------------------|------------------------------|
| 1 - CYLINDER HEAD COVER       | 18 - SPRING SEAT             |
| 2 - BREATHER HOSE             | 19 - VALVE STEM SEAL         |
| 3 - GASKET                    | 20 - SPRING                  |
| 4 - PCV VALVE                 | 21 - SEAL                    |
| 5 - OIL FILLER CAP            | 22 - HEAD GASKETS            |
| 6 - GASKET                    | 23 - WASHER                  |
| 7 - CYLINDER HEAD COVER       | 24 - SEAL                    |
| 8 - CAMSHAFT THRUST CASE      | 25 - CYLINDER HEAD BOLT      |
| 9 - CAMSHAFT (LEFT SIDE)      | 26 - SEAL                    |
| 10 - O-RING                   | 27 - CAP                     |
| 11 - EXHAUST ROCKER ARM SHAFT | 28 - SPRING                  |
| 12 - EXHAUST ROCKER ARM       | 29 - CAP                     |
| 13 - HYDRAULIC LASH ADJUSTER  | 30 - SEAL                    |
| 14 - SPRING RETAINER          | 31 - INTAKE ROCKER ARMS      |
| 15 - LOCKS                    | 32 - INTAKE ROCKER ARM SHAFT |
| 16 - CAP                      | 33 - CAMSHAFT (RIGHT SIDE)   |
| 17 - VALVE                    |                              |

9509-375

## INSTALLATION

**CAUTION:** When cleaning cylinder head surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use ONLY a wooden or plastic scraper.

- (1) Clean surfaces of cylinder head and block. Install new head gasket over locating dowels.
- (2) Install cylinder head on locating dowels.

- (3) Install 10 mm Allen hex head bolts with washers.

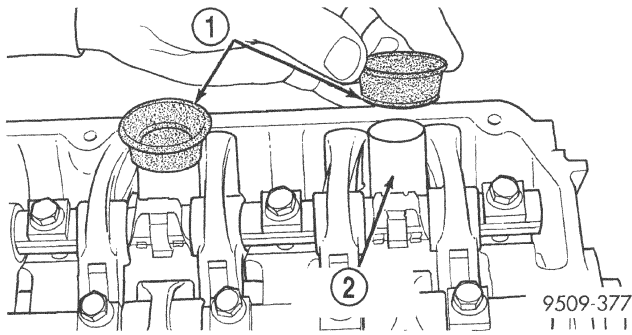
**CAUTION:** Attach the head bolt washer in the direction shown in (Fig. 54).

- (4) Tighten cylinder head bolts using the following procedure:

- (a) Tighten cylinder head bolts in sequence (Fig. 55) to 108 N·m (80 ft. lbs.).

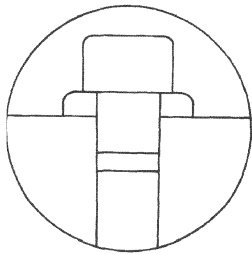


## REMOVAL AND INSTALLATION (Continued)



**Fig. 53 Spark Plug Tube Seal**

- 1 - SEALS  
2 - SPARK PLUG TUBE

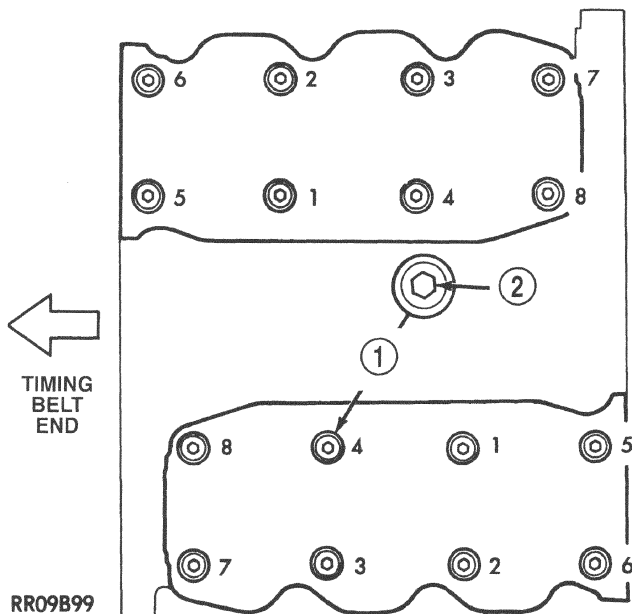


CYLINDER HEAD  
BOLT WASHER

80b01cfb

**Fig. 54 Cylinder Head Bolt Washer**

- (b) Loosen all bolts fully.  
(c) Retighten cylinder head bolts in sequence (Fig. 55) to 108 N·m (80 ft. lbs.).



**Fig. 55 Cylinder Head Bolt Tightening Sequence**

- 1 - CYLINDER HEAD BOLT AND WASHER  
2 - 10 mm ALLEN HEX

- (5) Install bolts attaching thermostat housing assembly to cylinder head.

- (6) Install distributor. Refer to Group 8D, Ignition System for procedure.

- (7) Install rocker arm assemblies and cylinder head covers. Refer to procedure in this section.

- (8) Install camshaft sprockets and timing belt. Refer to procedures in this section.

- (9) Install lower and upper intake manifold. Refer to procedure in this section.

- (10) Install exhaust cross-under pipe and connect exhaust system to manifold flange.

- (11) Fill cooling system. Refer to Group 7, Cooling System for procedure.

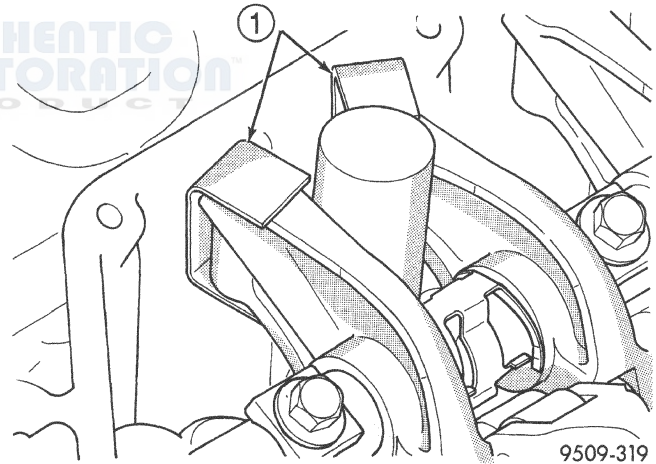
## ROCKER ARM AND HYDRAULIC ADJUSTER

### REMOVAL

- (1) Remove cylinder head cover(s). Refer to procedure in this section.

- (2) Identify the rocker arm shaft assemblies before removal.

- (3) Install auto lash adjuster retainers, Special Tool MD-998443 onto rocker arms (Fig. 56). These retainers hold the lash adjusters into position when the rocker arms are serviced.



**Fig. 56 Auto Lash Adjuster Retainers**

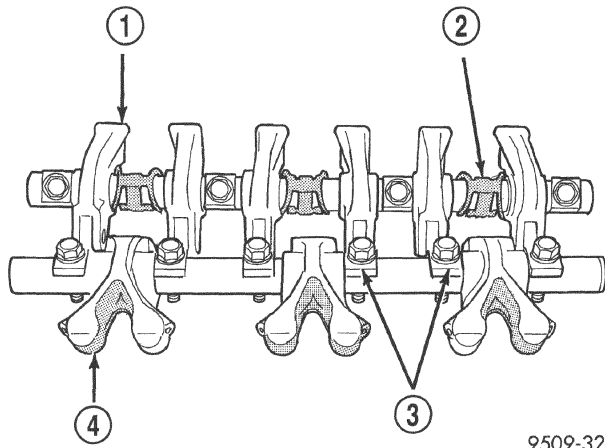
- 1 - SPECIAL TOOL MD998443

- (4) Loosen the attaching fasteners. Remove rocker arm shaft assemblies from cylinder head.

- (5) Mark rocker arm/hydraulic lash adjuster assemblies for reassembly in their original position. Remove rocker arm/hydraulic lash adjuster assembly. Lash adjusters are serviced as an assembly with the rocker arm (Fig. 57).

**NOTE:** The automatic lash adjusters are precision units installed in machined openings in the valve actuating ends of the rocker arms. Do not disassemble the auto lash adjuster.



**REMOVAL AND INSTALLATION (Continued)**

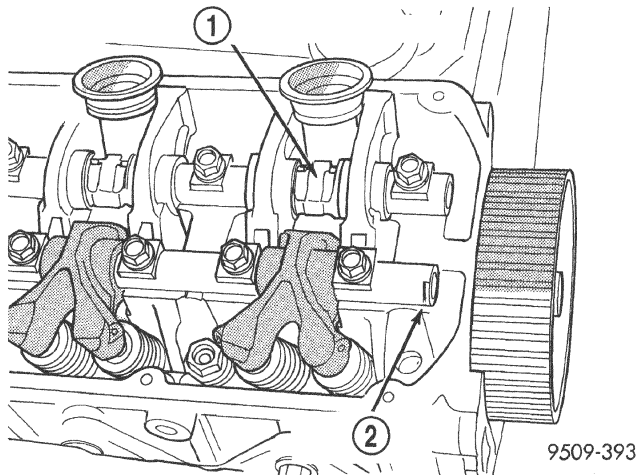
9509-323

**Fig. 57 Rocker Arm Shafts**

- 1 - INTAKE ROCKER ARMS
- 2 - ROCKER SHAFT SPRINGS
- 3 - ROCKER ARM SHAFT RETAINERS
- 4 - EXHAUST ROCKER ARMS

**INSTALLATION**

(1) Install rocker arm and shafts with the **FLAT** on the shafts facing the timing belt side of the right cylinder head (Fig. 58). For the left cylinder head, install rocker arm and shafts with the **FLAT** on the shafts facing the transmission side of the engine. Install the retainers and spring clips in their original positions on the exhaust and intake shafts (Fig. 57).



9509-393

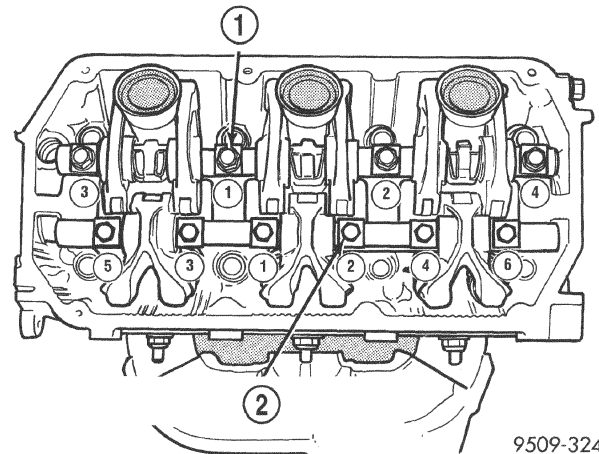
**Fig. 58 Rocker Arm Shaft Flat**

- 1 - ROCKER ARM SHAFT SPRING ORIENTATION
- 2 - DIRECTIONAL FLAT

(2) Tighten bolts to 31 N·m (276 in. lbs.) in sequence shown in (Fig. 59).

(3) Remove auto lash adjuster retainers Special Tool MD-998443 from rocker arms.

(4) Install cylinder head cover(s). Refer to procedure in this section.



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**Fig. 59 Rocker Arm Shaft Tightening Sequence**

- 1 - INTAKE ROCKER ARM SHAFT TIGHTEN SEQUENCE
- 2 - EXHAUST ROCKER ARM SHAFT TIGHTEN SEQUENCE

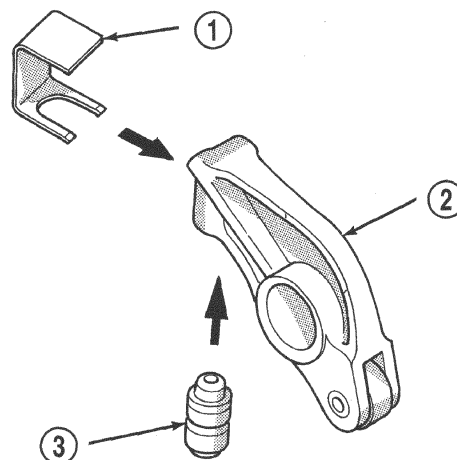
**CAMSHAFT****REMOVAL**

**NOTE: Cylinder head must be removed for camshaft replacement.**

(1) Remove upper and lower intake manifolds. Refer to procedures in this section.

(2) Remove cylinder head covers. Refer to procedure in this section.

(3) Install auto lash adjuster retainers, Special Tool MD-998443 (Fig. 60). These retainers hold the lash adjuster into position when the rocker arms are serviced.



9509-321

**Fig. 60 Retainer Auto Lash Adjuster**

- 1 - SPECIAL TOOL MD998443
- 2 - ROLLER ROCKER ARM
- 3 - HYDRAULIC LASH ADJUSTER

**REMOVAL AND INSTALLATION (Continued)**

(4) Mark rocker arm shaft assemblies for installation.

(5) Remove rocker arm shaft bolts. Refer to procedure in this section.

(6) Remove the timing belt and camshaft sprocket. Refer to procedures in this section.

(7) Remove cylinder head retaining bolts.

(8) Remove cylinder head(s) from vehicle.

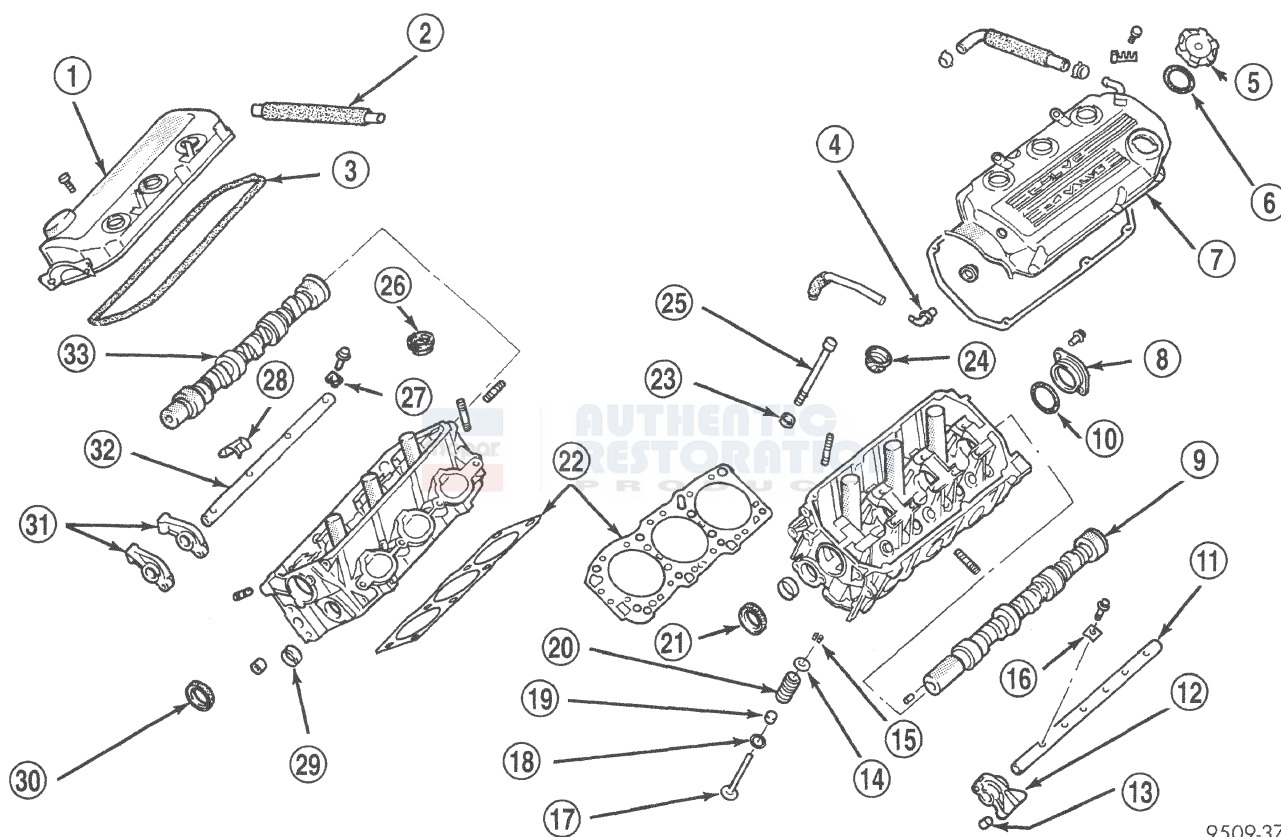
(9) Remove thrust case from front (left side) cylinder head assembly. Remove camshaft from the rear of the head (Fig. 61).

(10) Remove distributor (if not previously removed) from rear (right side) cylinder head assembly. Remove camshaft from rear of the head (Fig. 61).

**INSTALLATION**

(1) Lubricate camshaft journals. Install camshaft(s) into the cylinder head(s) carefully (Fig. 61).

(2) Install thrust case on front (left side) cylinder head and tighten fasteners to 13 N·m (108 in. lbs.) (Fig. 61).



9509-375

**Fig. 61 Cylinder Head Components**

1 - CYLINDER HEAD COVER

2 - BREATHER HOSE

3 - GASKET

4 - PCV VALVE

5 - OIL FILLER CAP

6 - GASKET

7 - CYLINDER HEAD COVER

8 - CAMSHAFT THRUST CASE

9 - CAMSHAFT (LEFT SIDE)

10 - O-RING

11 - EXHAUST ROCKER ARM SHAFT

12 - EXHAUST ROCKER ARM

13 - HYDRAULIC LASH ADJUSTER

14 - SPRING RETAINER

15 - LOCKS

16 - CAP

17 - VALVE

18 - SPRING SEAT

19 - VALVE STEM SEAL

20 - SPRING

21 - SEAL

22 - HEAD GASKETS

23 - WASHER

24 - SEAL

25 - CYLINDER HEAD BOLT

26 - SEAL

27 - CAP

28 - SPRING

29 - CAP

30 - SEAL

31 - INTAKE ROCKER ARMS

32 - INTAKE ROCKER ARM SHAFT

33 - CAMSHAFT (RIGHT SIDE)

## REMOVAL AND INSTALLATION (Continued)

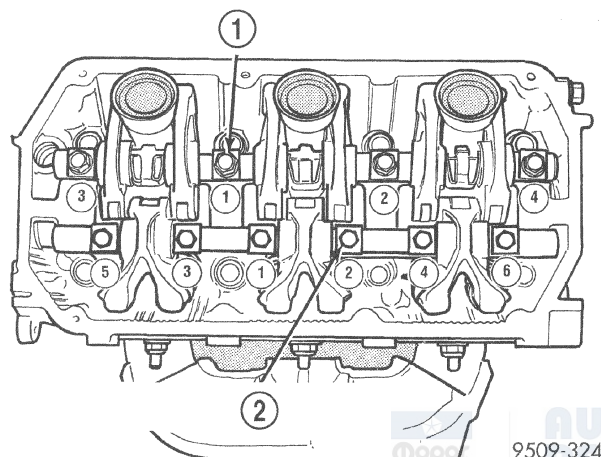
(3) Install camshaft seal(s). Camshaft must be installed before the camshaft seal is installed. Refer to procedure in this section.

(4) Install camshaft sprocket(s) and tighten to 88 N·m (65 ft. lbs.).

(5) Install timing belt. Refer to procedure in this section.

(6) Install rocker arm assemblies in correct order as removed. Tighten the rocker arm assemblies in sequence shown in (Fig. 62) to 31 N·m (276 in. lbs.).

(7) Remove Special Tools MD-998443, auto lash adjuster retainers.



**Fig. 62 Rocker Arm Shaft Tightening Sequence**

- 1 - INTAKE ROCKER ARM SHAFT TIGHTEN SEQUENCE  
2 - EXHAUST ROCKER ARM SHAFT TIGHTEN SEQUENCE

(8) Install cylinder head covers, lower intake manifold, and upper intake manifold. Refer to procedures in this section.

### CAMSHAFT END PLAY

(1) Oil camshaft journals and install camshaft without rocker arm assemblies.

(2) Using a suitable tool, move camshaft as far rearward as it will go.

(3) Zero dial indicator (Fig. 63).

(4) Move camshaft as far forward as it will go.

(5) End play travel: 0.1 - 0.2 mm (0.004 - 0.008 in.). Max. Travel: 0.4 mm (0.016 in.).

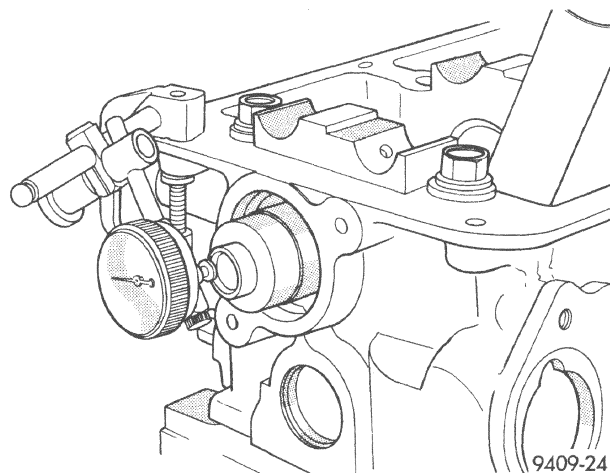
### VALVE SPRINGS AND SEALS—IN VEHICLE SERVICE

#### REMOVAL

(1) Remove cylinder head cover(s). Refer to procedure in this section.

(2) Remove rocker arm shaft assemblies. Refer to procedure in this section.

(3) Rotate crankshaft until piston is at TDC on compression stroke.



**Fig. 63 Camshaft End Play**

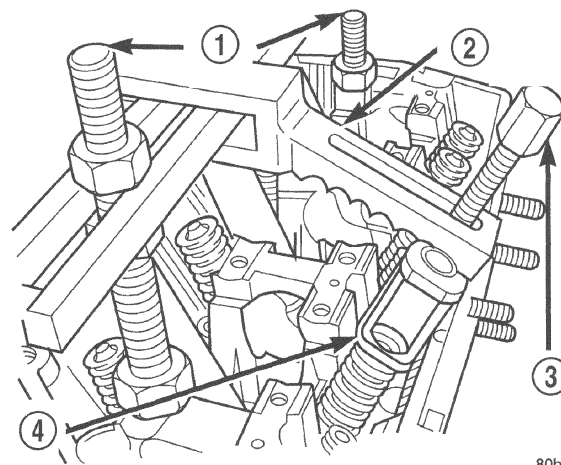
(4) Remove spark plug from applicable cylinder.

(5) Using a air hose attached to an adapter tool, install it into the spark plug hole. Apply 90-120 psi air pressure.

(6) Use Special Tool MD-998772A with Mounting Post 6886, Forcing Screw Arm 6887, Forcing Screw 6765 and Adapter 6885 (Fig. 64) to compress valve springs and remove valve locks.

(7) Remove valve spring.

(8) Remove valve stem seals with suitable tool (Fig. 65).



**Fig. 64 Valve Springs—Removing and Installing**

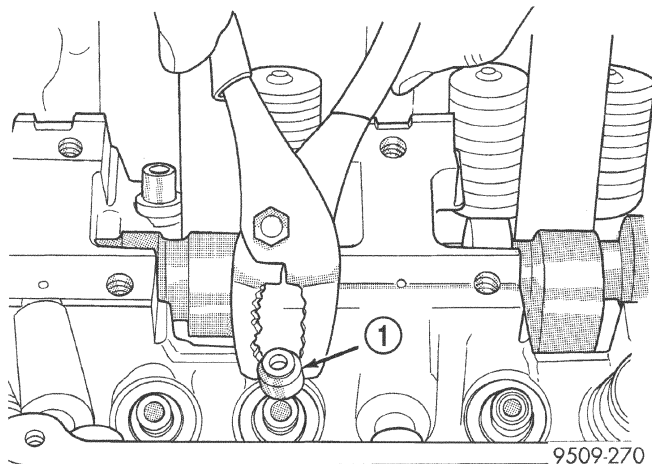
- 1 - MOUNTING POST 6886  
2 - FORCING SCREW ARM 6887  
3 - FORCING SCREW 6765  
4 - ADAPTER 6885

#### INSTALLATION

(1) Install the "gray" valve seal onto the intake valve guide and the "grayish green" seal onto the exhaust valve guide (Fig. 66).

(2) Using Special Tool MD-998774, install valve seal by tapping lightly until seal is in place (Fig. 67).

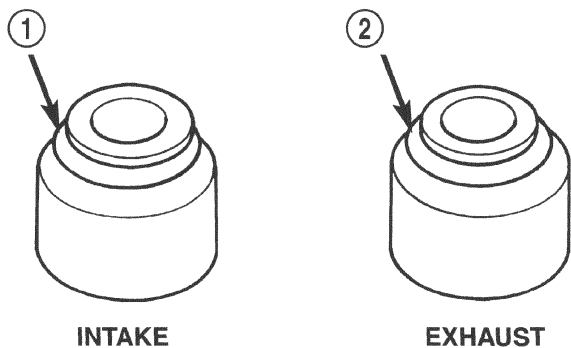


**REMOVAL AND INSTALLATION (Continued)****Fig. 65 Valve Stem Seal—Removal**

1 - VALVE STEM SEAL

(3) Use Special Tool MD-998772A with Mounting Post 6886, Forcing Screw Arm 6887, Forcing Screw 6765 and Adapter 6885 (Fig. 64) to compress valve springs only enough to install locks. Correct alignment of tool is necessary to avoid nicking valve stems.

(4) Repeat Removal Steps 3 through 7 and Installation Steps 1 through 3 until all necessary valve springs/seals are replaced.

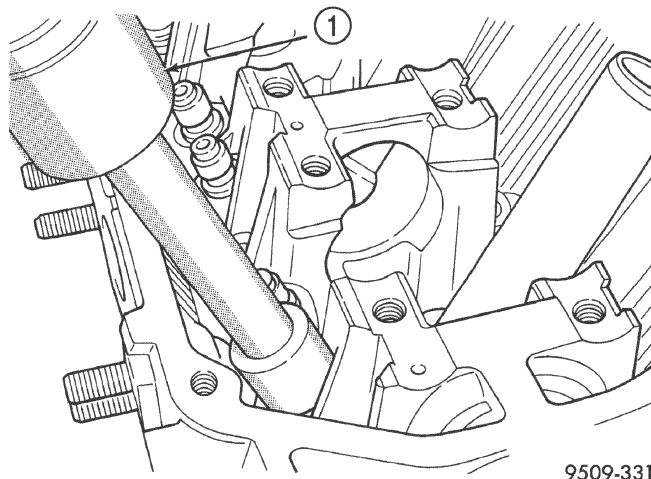
**Fig. 66 Valve Stem Seal Identification**

- 1 - GRAY
- 2 - GRAYISH GREEN

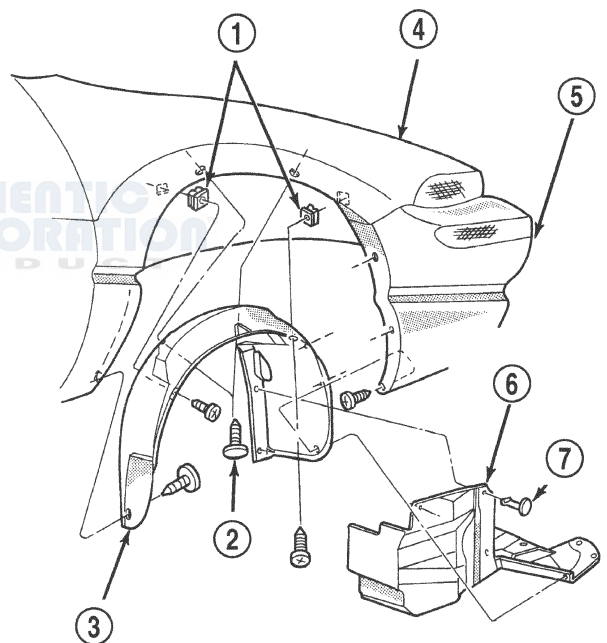
- (5) Install rocker arm shaft assemblies.
- (6) Install cylinder head cover.

**CRANKSHAFT DAMPER****REMOVAL**

- (1) Remove belt splash shield (Fig. 68).
- (2) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.

**Fig. 67 Valve Stem Seal—Installation**

1 - SPECIAL TOOL MD998774

**Fig. 68 Belt Splash Shield**

- 1 - NUT-SNAP
- 2 - PUSH-IN FASTENER
- 3 - WHEELHOUSE SPLASH SHIELD
- 4 - FENDER
- 5 - FASCIA
- 6 - ACCESSORY DRIVE BELT SPLASH SHIELD
- 7 - PUSH-IN FASTENER

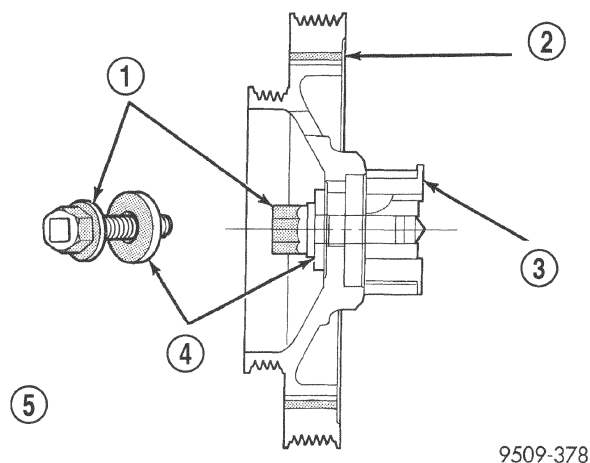
(3) Remove crankshaft center bolt (Fig. 69) and remove crankshaft damper.

**INSTALLATION**

- (1) Install crankshaft damper.



## REMOVAL AND INSTALLATION (Continued)



**Fig. 69 Crankshaft Damper**

- 1 - CRANKSHAFT BOLT 22 mm OR 1/2" SQUARE
- 2 - RUBBER
- 3 - CRANKSHAFT SPROCKET
- 4 - WASHER
- 5 - BOLT TORQUE 182 N·m (134 FT. LBS.)

(2) Install crankshaft bolt and tighten to 182 N·m (134 ft. lbs.) (Fig. 69).

(3) Install accessory drive belts. Refer to Group 7, Cooling System for procedures.

(4) Install belt shield (Fig. 68).

## TIMING BELT COVERS

### REMOVAL

(1) Disconnect negative cable from battery remote jumper terminal.

(2) Remove drive belt splash shield. Refer to Group 23, Body for procedure.

(3) Remove the accessory drive belts. Refer to Group 7, Cooling System for service procedure.

(4) Support engine and remove right engine mount. Refer to Engine Mounts in this section for procedure.

(5) Remove crankshaft damper. Refer to procedure in this section.

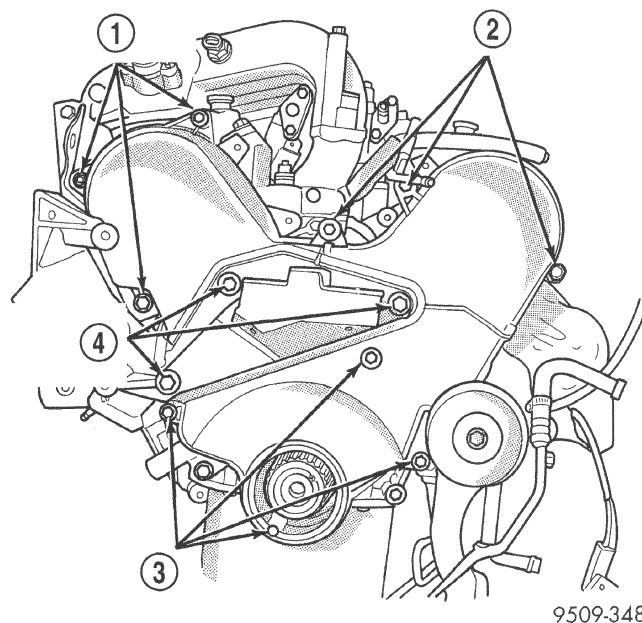
**NOTE:** To remove engine mount bracket the lower timing belt cover must be removed first.

(6) Remove power steering pump bracket. Refer to Group 19, Steering for procedure.

(7) Remove the timing belt covers (Fig. 70). Remove covers in this order:

- (a) Upper left cover.
- (b) Lower cover.
- (c) Upper right cover.

**NOTE:** To remove right/rear timing belt cover, the power steering pump bracket must be removed.



**Fig. 70 Timing Belt Covers**

- 1 - UPPER RIGHT TIMING BELT COVER FASTENERS
- 2 - UPPER LEFT TIMING BELT COVER FASTENERS
- 3 - LOWER TIMING BELT COVER FASTENERS
- 4 - ENGINE BRACKET FASTENERS

(8) Remove the engine mount bracket (Fig. 70).

### INSTALLATION

(1) Install engine mount bracket (Fig. 70).

(2) Install timing belt covers (Fig. 70) in this order:

- (a) Upper right cover.
- (b) Lower cover.
- (c) Upper left cover.

(3) Install power steering pump bracket. Refer to Group 19, Steering for procedure.

(4) Install crankshaft damper. Refer to procedure in this section.

(5) Install right engine mount. Refer to Engine Mounts in this section for procedure.

(6) Install accessory drive belts. Refer to Group 7, Cooling System for service procedure.

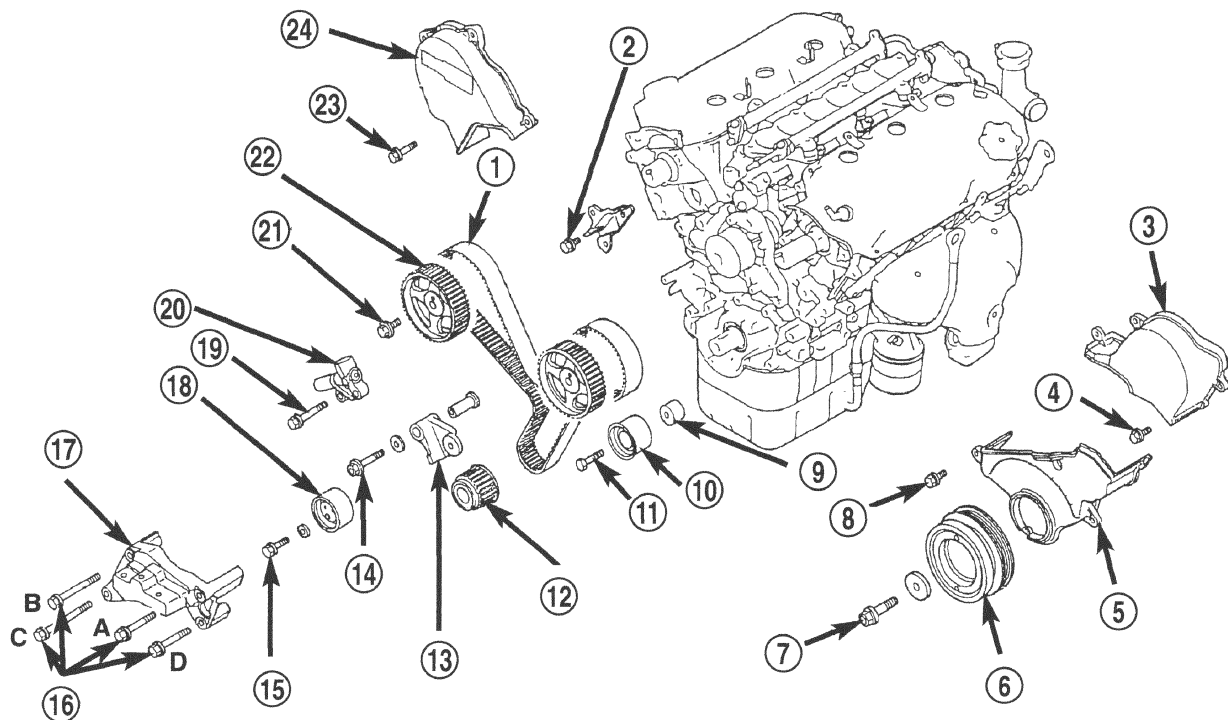
(7) Install drive belt splash shield. Refer to Group 23, Body for procedure.

(8) Connect negative cable from battery remote jumper terminal.

### TIMING BELT

**CAUTION:** The 2.5L engine is a Non-freewheeling design. When the timing belt is removed, DO NOT rotate the camshafts or crankshaft without first locating the proper crankshaft position. Failure to do so will result in valve and/or piston damage

## REMOVAL AND INSTALLATION (Continued)



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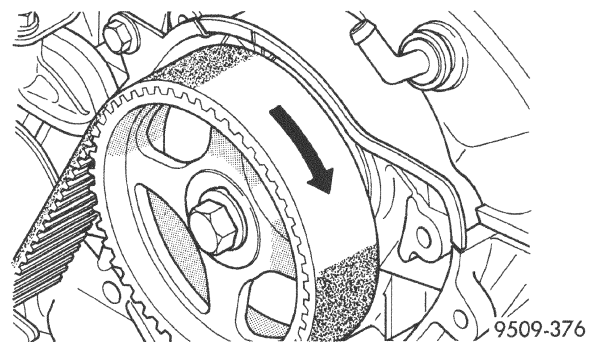
Fig. 71 Timing Belt System

- |                                  |                                    |
|----------------------------------|------------------------------------|
| 1 - TIMING BELT                  | 15 - 48 N•m (35 ft. lbs.)          |
| 2 - 14 N•m (10 ft. lbs.)         | 16 - 45 N•m (33 ft. lbs.)          |
| 3 - UPPER LEFT TIMING BELT COVER | TIGHTENING ORDER                   |
| 4 - 14 N•m (10 ft. lbs.)         | A-B-C-D                            |
| 5 - LOWER TIMING BELT COVER      |                                    |
| 6 - CRANKSHAFT DAMPER            | 17 - ENGINE MOUNT BRACKET          |
| 7 - 182 N•m (134 ft. lbs.)       | 18 - TENSIONER PULLEY              |
| 8 - 11 N•m (8 ft. lbs.)          | 19 - 23 N•m (17 ft. lbs.)          |
| 9 - SPACER                       | 20 - TENSIONER                     |
| 10 - IDLER PULLEY                | 21 - CAMSHAFT SPROCKET BOLT        |
| 11 - 44 N•m (33 ft. lbs.)        | 88 N•m (65 ft. lbs.)               |
| 12 - CRANKSHAFT SPROCKET         | 22 - CAMSHAFT SPROCKET             |
| 13 - TENSIONER ARM               | 23 - 14 N•m (10 ft. lbs.)          |
| 14 - 44 N•m (33 ft. lbs.)        | 24 - UPPER RIGHT TIMING BELT COVER |

## REMOVAL

- (1) Remove timing belt covers. Refer to procedure in this section.
- (2) Mark timing belt running direction for installation (Fig. 72).
- (3) Loosen timing belt tensioner center bolt (Fig. 73) and remove auto tensioner.
- (4) Remove timing belt.

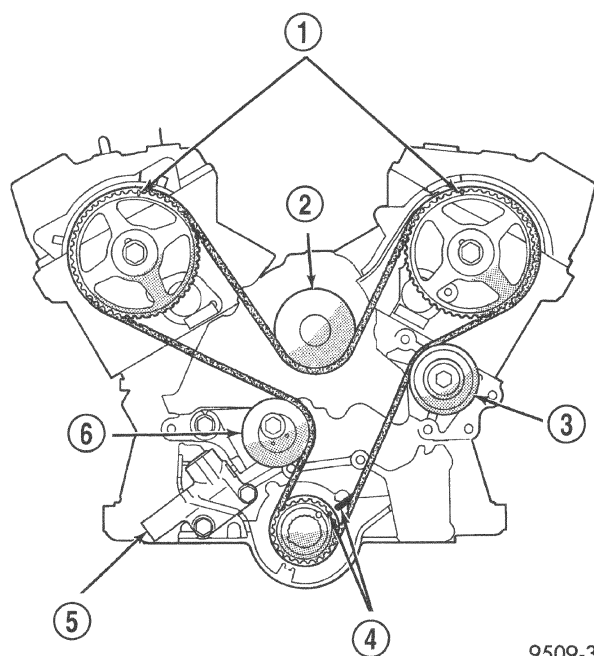
**CAUTION:** Coolant or oil leakage on timing belt will shorten its life drastically. If timing belt is seriously contaminated, it must be replaced. Clean all components and correct source of leak.



9509-376

Fig. 72 Mark Direction of Timing Belt

## REMOVAL AND INSTALLATION (Continued)



9509-313

**Fig. 73 Timing Belt Engine Sprocket Timing**

- 1 - CAMSHAFT SPROCKETS ALIGN TO TIMING MARKS
- 2 - WATER PUMP PULLEY
- 3 - IDLER PULLEY
- 4 - CRANKSHAFT SPROCKET ALIGN TO TIMING MARK
- 5 - AUTO TENSIONER
- 6 - TENSIONER PULLEY

## CAMSHAFT AND CRANKSHAFT TIMING PROCEDURE

### TIMING BELT TENSIONER

(1) When tensioner is removed from the engine it is necessary to compress the plunger into the tensioner body.

(2) Place the tensioner into a vise and slowly compress the plunger (Fig. 74).

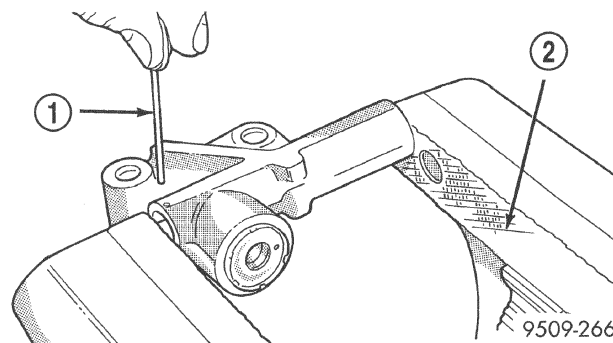
**CAUTION:** Index the tensioner in the vise the same way it is installed on the engine. This is to ensure proper locking pin orientation when tensioner is installed on the engine.

(3) When plunger is compressed into the tensioner body, install a locking pin through the body and plunger (Fig. 74).

### INSTALLATION

(1) Set crankshaft sprocket to TDC by aligning the sprocket mark with the mark on the oil pump housing. Then rotate crankshaft 3 notches before TDC (Fig. 75).

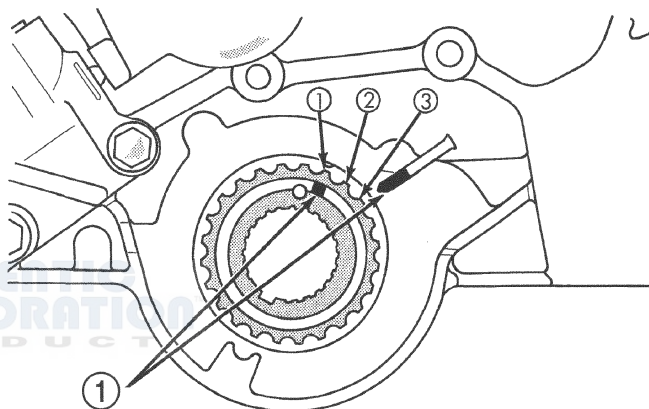
(2) Set camshaft sprockets to the aligning marks on the sprockets with the marks on the rear timing belt cover (Fig. 76).



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**Fig. 74 Timing Belt Tensioner Compressing**

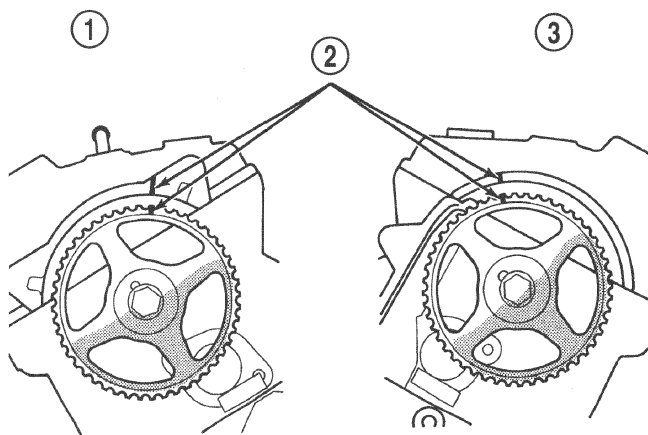
- 1 - LOCKING PIN
- 2 - SOFT JAW VISE



9509-349

**Fig. 75 Crankshaft Sprocket Timing**

- 1 - TIMING MARKS



9509-312

**Fig. 76 Camshaft Sprocket Timing**

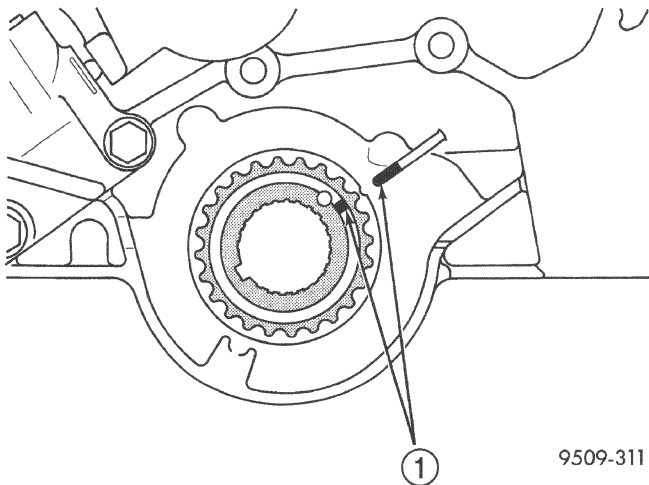
- 1 - RIGHT CAM SPROCKET
- 2 - ALIGN TIMING MARKS
- 3 - LEFT CAM SPROCKET



**REMOVAL AND INSTALLATION (Continued)**

(3) Install timing belt on right camshaft sprocket. Install a binder clip on the belt and sprocket so the belt will not slip out of position. Keeping the belt taught, install belt under the water pump pulley and then around the left camshaft sprocket. Install an additional binder clip on the left sprocket and belt.

(4) Rotate the crankshaft to TDC (Fig. 77). Continue routing the belt around the idler pulley, crankshaft sprocket, and tensioner pulley.



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**Fig. 77 Adjusting Crankshaft Sprocket for Timing Belt**

1 - TIMING MARKS

(5) To tension belt perform the following:

(a) Apply rotating force to the crankshaft sprocket in the clockwise direction, check that all timing marks are aligned.

(b) Loosen tensioner pulley center bolt.

(c) Using Special Tool MD 998767 and a torque wrench on the tensioner pulley. Apply 4.4 N·m (38.9 in. lbs.) of torque to tensioner (Fig. 78). Tighten tensioner pulley bolt to 48 N·m (35 ft. lbs.).

(d) With torque being applied to the tensioner pulley, install the hydraulic tensioner to the tensioner pulley bracket. Tighten tensioner fasteners to 23 N·m (205 in. lbs.).

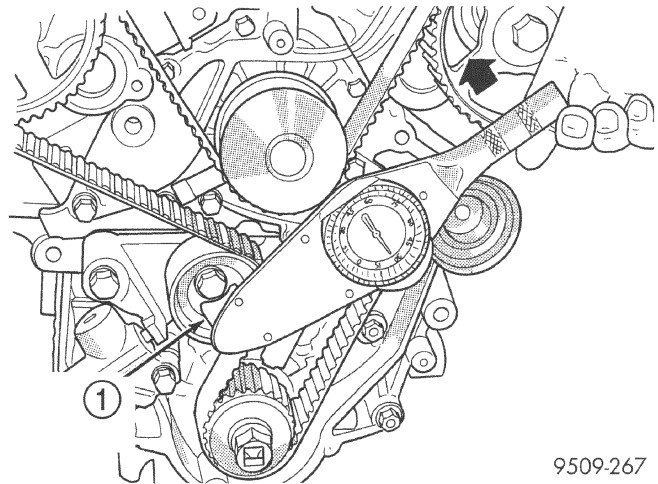
(e) Pull tensioner plunger pin.

(6) Rotate crankshaft 2 revolutions in a clockwise direction ONLY and check the alignment of the timing marks (Fig. 73). Install tensioner pin into assembly. The pin should slide in and out without any resistance. If the pin does not slide freely, perform the procedure again.

(7) Install timing belt covers. Refer to procedure in this section.

(8) Install right engine mount. Refer to procedure in this section.

(9) Install crankshaft damper and crankshaft damper bolt. Tighten to 182 N·m (134 ft. lbs.).



9509-267

**Fig. 78 Timing Belt Tension Adjustment**

1 - SPECIAL TOOL MD 998767

(10) Install accessory drive belts. Refer to Group 7, Cooling System for the procedure.

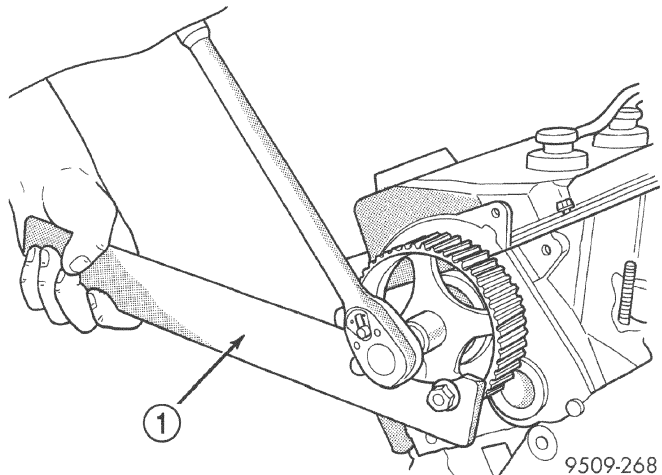
(11) Raise vehicle on hoist and install drive belt splash shield.

**CAMSHAFT SPROCKETS****REMOVAL**

(1) Remove timing belt. Refer to procedure in this section.

(2) Hold camshaft sprocket with Special Tool 6847. Loosen and remove bolt and washer (Fig. 79).

(3) Remove camshaft sprocket from camshaft.



9509-268

**Fig. 79 Camshaft Sprockets—Removal and Installation**

1 - SPECIAL TOOL 6847

**INSTALLATION**

(1) Place camshaft sprocket on camshaft.



## REMOVAL AND INSTALLATION (Continued)

(2) Install bolt and washer to camshaft. Using Special Tool 6847, hold camshaft sprocket and torque bolt to 88 N·m (65 ft. lbs.) (Fig. 79).

(3) Install timing belt. Refer to procedure in this section.

## CAMSHAFT OIL SEAL

### REMOVAL

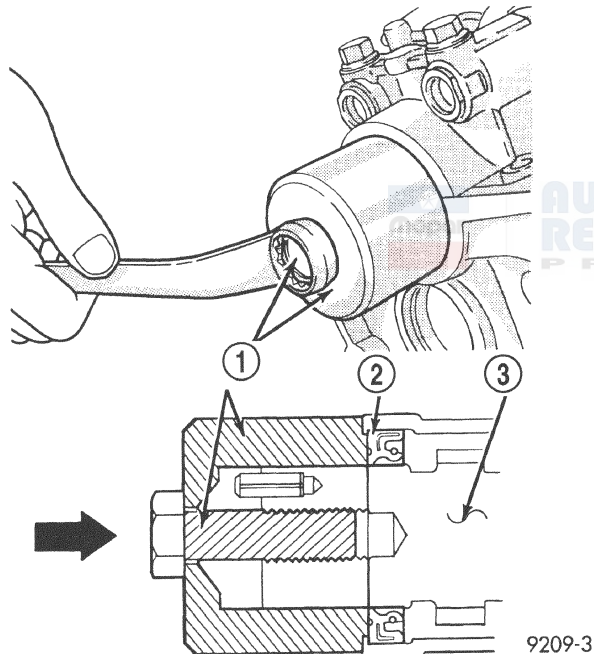
(1) Remove timing belt and camshaft sprocket(s). Refer to procedures in this section.

(2) Remove camshaft seal(s).

### INSTALLATION

(1) Apply light coat of engine oil to the camshaft oil seal lip.

(2) Install the oil seal using Special Tool MD998713 or 6863 camshaft oil seal installers (Fig. 80) and (Fig. 81).



**Fig. 80 Camshaft Oil Seal Installation—Right Cylinder Head**

- 1 - SPECIAL TOOL MD-998713
- 2 - SEAL
- 3 - CAMSHAFT

## OIL PAN

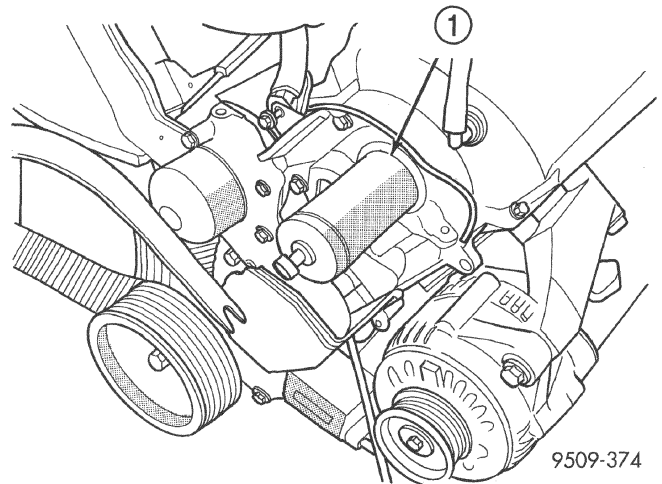
### REMOVAL

(1) Disconnect negative cable from remote battery jumper terminal (Fig. 82).

(2) Remove oil drain plug and drain oil (Fig. 83).

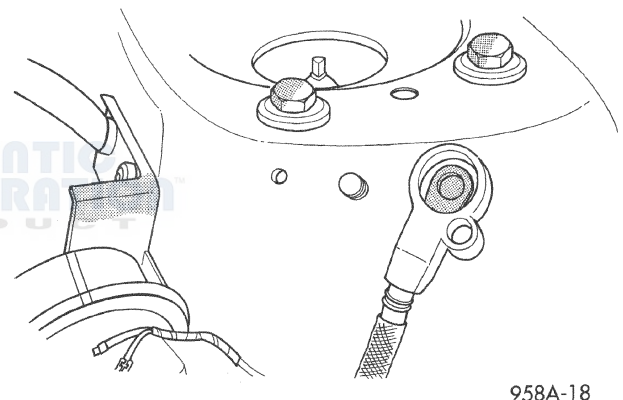
(3) Remove exhaust cross-under pipe. Refer to Exhaust Manifold, in this section for procedure.

(4) Remove drive belt splash shield.



**Fig. 81 Camshaft Oil Seal Installation—Left Cylinder Head**

- 1 - SPECIAL TOOL 6863



**Fig. 82 Battery Negative Cable Remote Terminal Location**

(5) Remove dipstick tube.

(6) Remove starter motor. Refer to Group 8B, Battery/Starter/Generator Service for procedure.

(7) Remove engine to transaxle struts/bending braces.

(8) Remove transaxle inspection cover.

(9) Remove oil pan.

### INSTALLATION

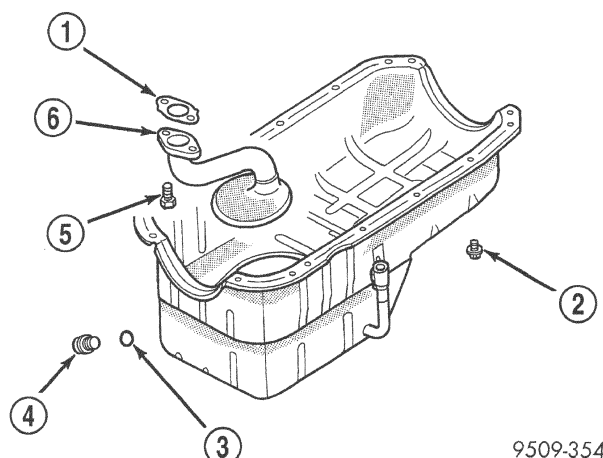
**NOTE:** Oil pan to cylinder block sealing is provided with Mopar® RTV GEN II or equivalent gasket material. See Form-In-Place Gaskets in this section.

(1) Apply sealant as shown in (Fig. 84).

(2) Install pan and tighten screws to 6 N·m (50 in. lbs.).

(3) Install transaxle inspection cover.

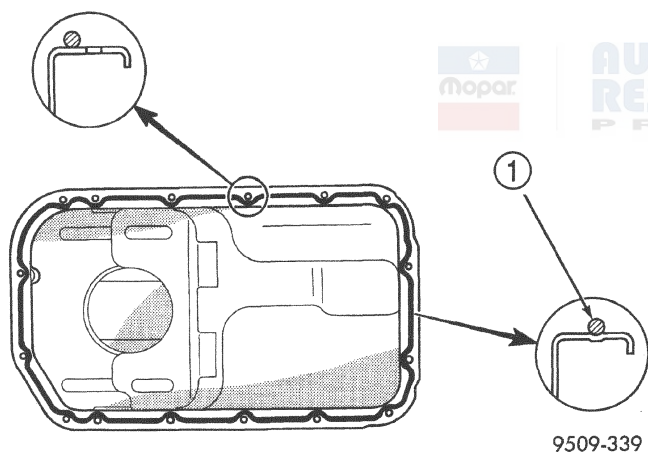
(4) Install engine to transaxle struts/bending braces.

**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 83 Oil Pan**

- 1 - GASKET
- 2 - SCREW
- 3 - GASKET
- 4 - OIL DRAIN PLUG
- 5 - BOLT
- 6 - OIL PICKUP



9509-339

**Fig. 84 Oil Pan Sealing**

- 1 - .157 in (4 mm) DIAMETER OF SEALANT

(5) Install exhaust cross-under pipe. Refer to Exhaust Manifold in this section for procedure.

(6) Install starter motor. Refer to Group 8B, Starting for procedure.

(7) Install drive belt splash shield.

(8) Inspect dipstick tube O-ring and replace as necessary.

(9) Install dipstick tube.

(10) Install correct amount of engine oil.

(11) Connect negative cable to battery remote jumper terminal.

**CRANKSHAFT OIL SEAL—FRONT****REMOVAL**

(1) Remove crankshaft damper. Refer to procedure in this section.

(2) Remove timing belt covers and timing belt. Refer to procedures in this section.

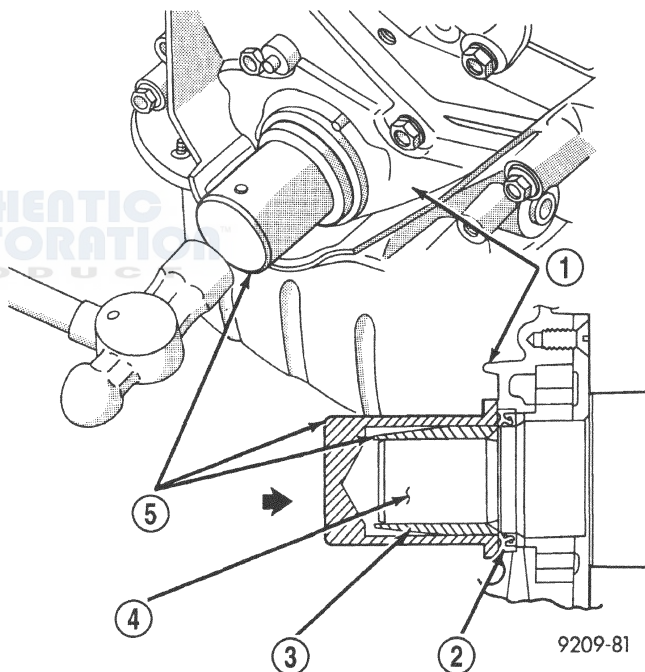
(3) Remove crankshaft sprocket and key.

(4) Pry out the front seal with a flat tip screwdriver. Cover the end of the screwdriver with a shop towel.

**CAUTION:** Be careful not to nick or damage crankshaft flange surface or oil pump housing bore.

**INSTALLATION**

(1) Install front crankshaft seal into oil pump housing using Special Tool MD-998717 (Fig. 85).



9209-81

**Fig. 85 Front Crankshaft Oil Seal**

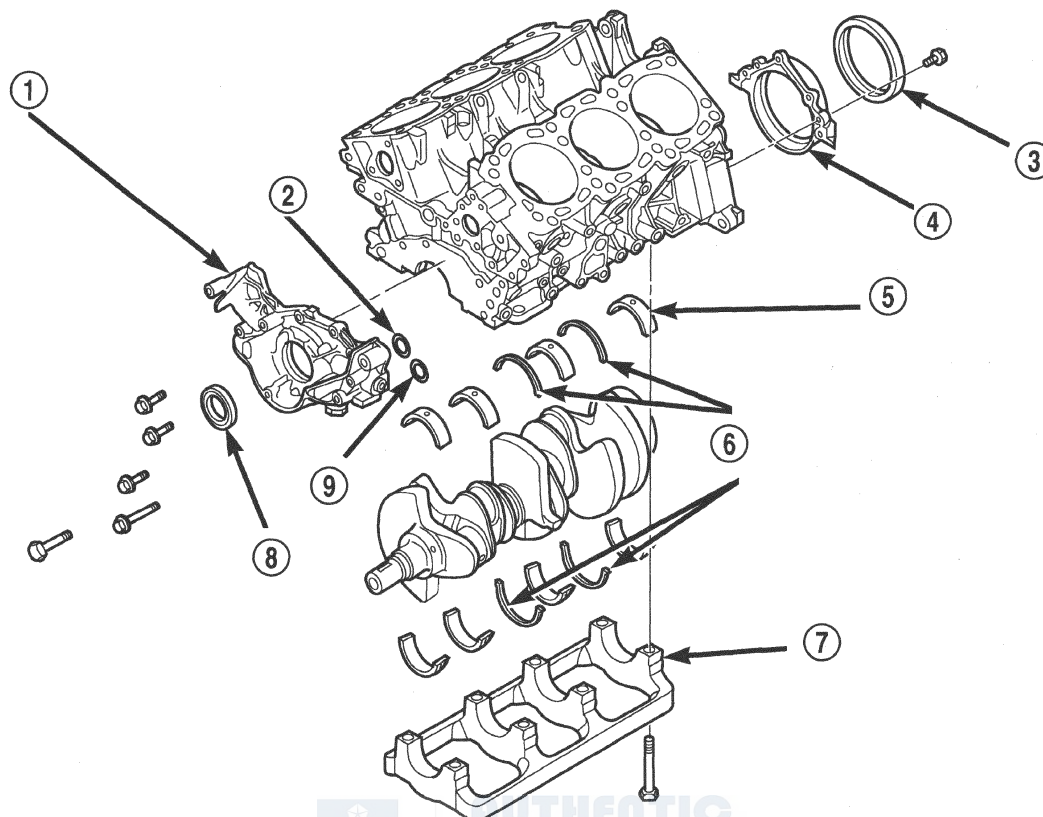
- 1 - PUMP CASE
- 2 - SEAL
- 3 - GUIDE
- 4 - CRANKSHAFT
- 5 - SPECIAL TOOL MD-998717

(2) Install crankshaft key and sprocket.

(3) Install timing belt and covers. Refer to procedures in this section.

(4) Install crankshaft damper. Refer to procedure in this section.

## REMOVAL AND INSTALLATION (Continued)



**Fig. 86 Crankshaft and Cylinder Block**

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- 1 - OIL PUMP ASSEMBLY
- 2 - O-RING
- 3 - SEAL
- 4 - CASE
- 5 - UPPER BEARING (GROOVED)

- 6 - THRUST BEARINGS (2 PAIRS)
- 7 - MAIN BEARING MONOBLOCK CAP
- 8 - SEAL
- 9 - O-RING

## CRANKSHAFT

### REMOVAL

(1) Remove engine assembly from vehicle. Refer to procedure in this section.

(2) Separate engine from transaxle and remove flex plate.

(3) Remove rear oil seal retainer and seal as an assembly (Fig. 88).

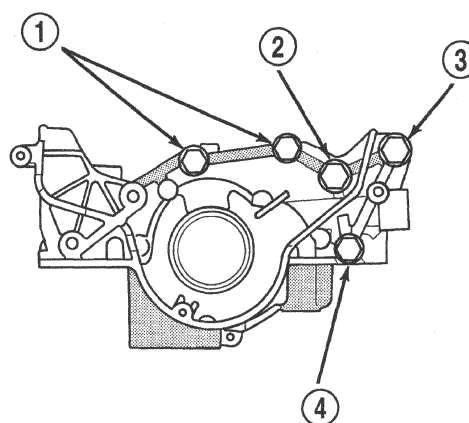
(4) Mount engine on a suitable engine repair stand.

(5) Remove oil pan.

(6) Remove front mounted oil pump assembly (Fig. 86) and (Fig. 87).

(7) Mark position of each connecting rod and cap. Remove connecting rod bearing caps.

(8) Release monoblock main bearing cap bolts evenly. Remove lower bearing shells and identify for reassembly.



**Fig. 87 Oil Pump**

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- 1 - M8 × 25 MM (1 IN.)
- 2 - M8 × 30 MM (1 3/16 IN.)
- 3 - M10 × 50 MM (1 31/32 IN.)
- 4 - M8 × 60 MM (2 3/8 IN.)



**REMOVAL AND INSTALLATION (Continued)**

(9) Lift out crankshaft and remove upper thrust washers from each side of number three main bearing in the crankcase (Fig. 86).

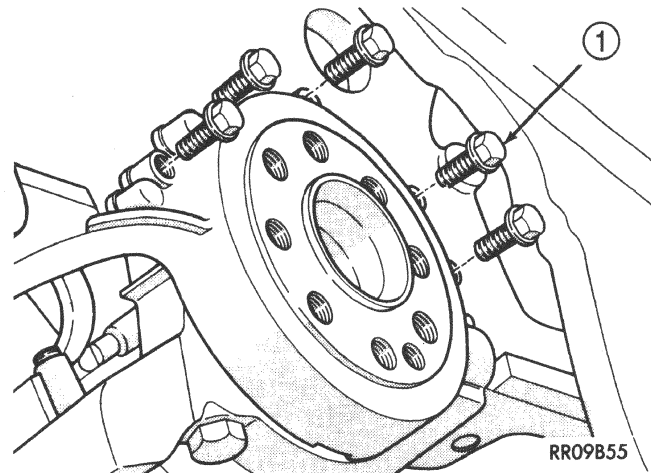
**INSTALLATION**

(1) Select the proper size main bearings. Refer to Main Bearing Fitting in this section.

(2) Install upper main bearing shells making certain oil holes are in alignment, and bearing tabs seat in block tabs. All upper bearings have oil grooves (Fig. 89).

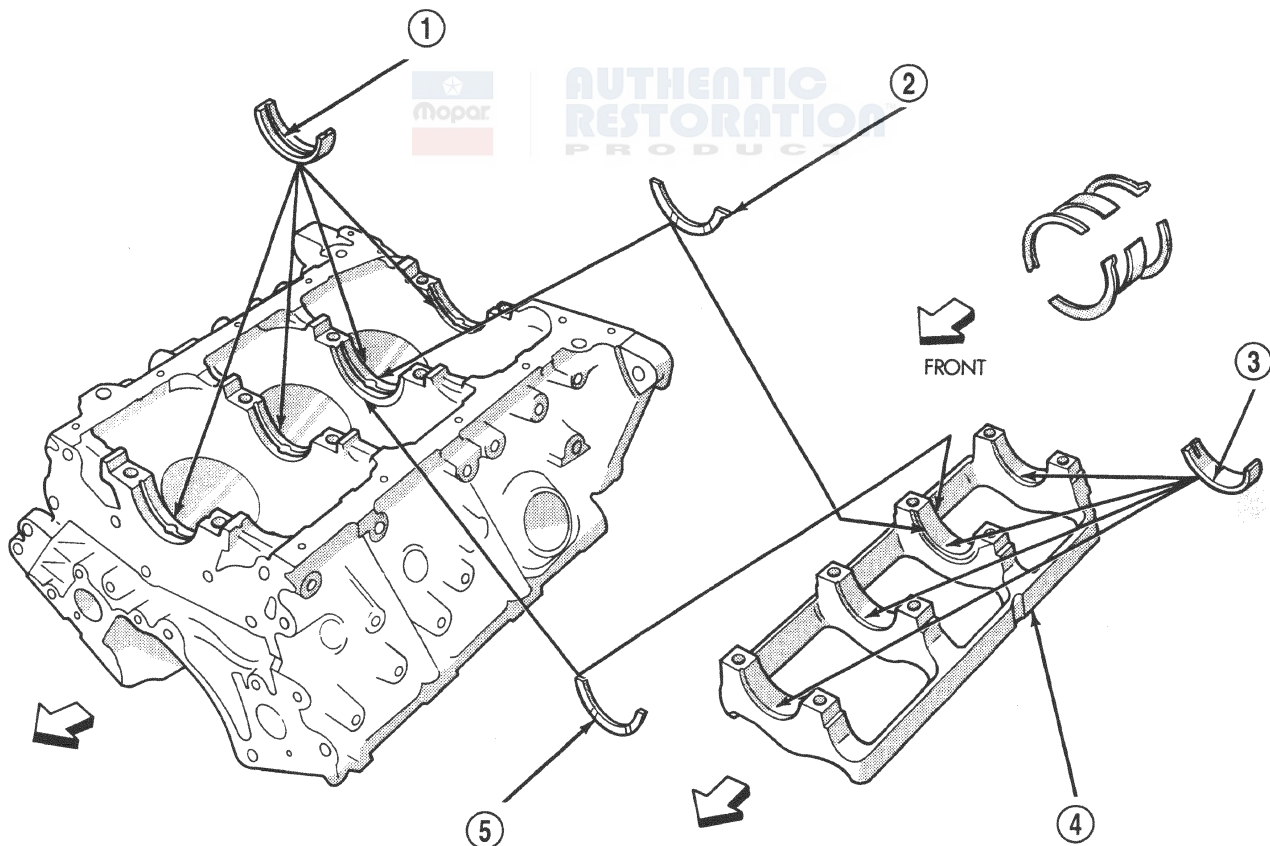
(3) **THRUST BEARINGS.** Crankshaft thrust bearings (washers) are installed at journal #3 separately from the radial bearings. Thrust bearings are different, one has end positioning tabs, while the other is plain. One **pair** of each thrust washers are installed into the block and one **pair** into the main bearing cap (Fig. 89).

(4) Apply a thin film of grease to plain side of thrust washers and position them on each side of number three main bearing. Grooved surface towards crankshaft.

**Fig. 88 Rear Seal Assembly**

1 - 10mm (104 IN. LBS.)

(5) Oil the bearings and journals and install crankshaft.

**Fig. 89 Main Bearings Installation**

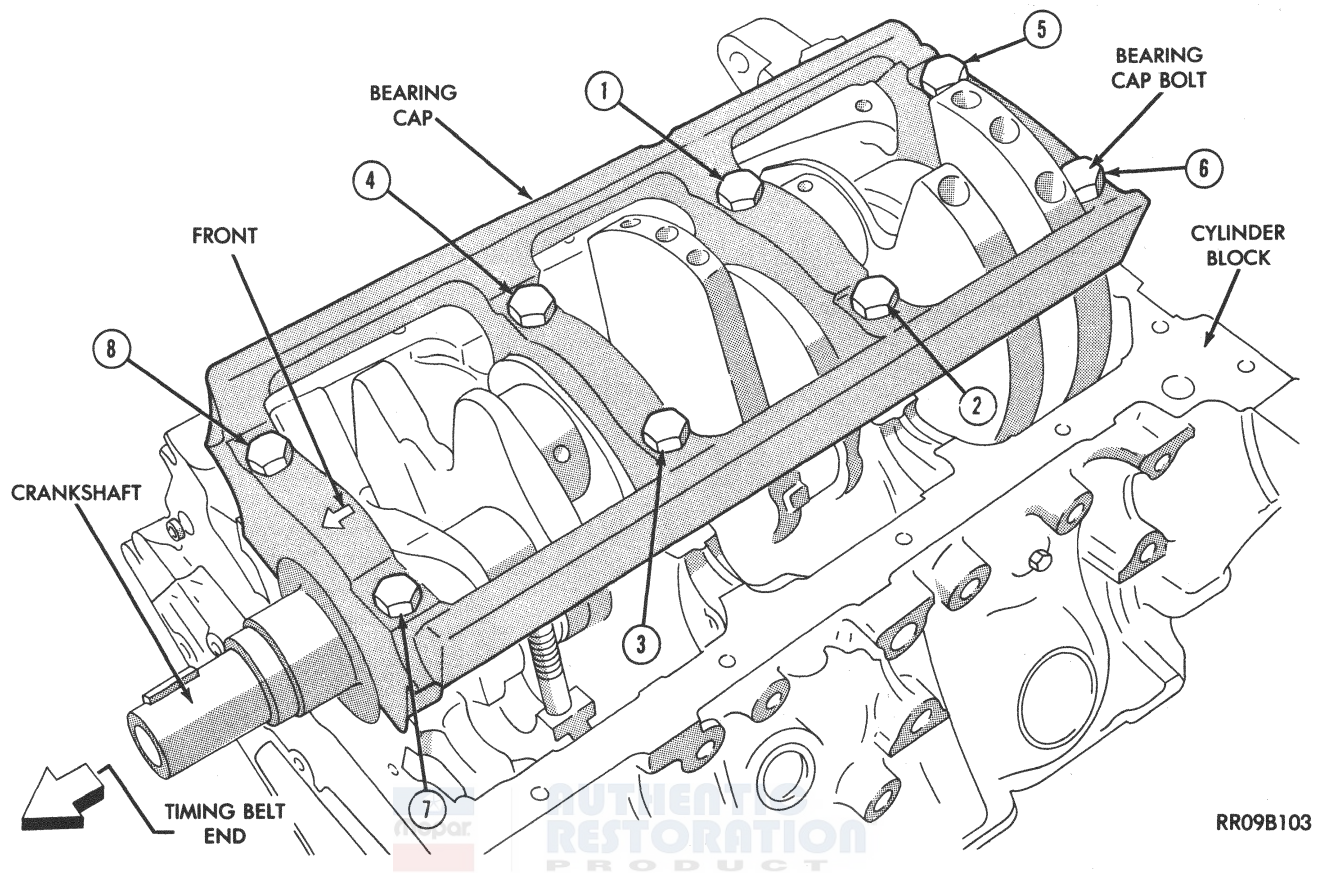
9209-78

- 1 - GROOVED
- 2 - THRUST BEARING WITH TAB
- 3 - PLAIN

- 4 - MONOBLOCK MAIN BEARING CAP
- 5 - THRUST BEARING WITHOUT TAB



## REMOVAL AND INSTALLATION (Continued)



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**Fig. 90 Crankshaft Main Bearing Cap**

(6) Install lower main bearing shells (without oil grooves) in monoblock cap.

(7) Install one pair of thrust washers in cap.

(8) Carefully install bearing cap with arrows (Fig. 90) toward timing belt end.

(9) Oil the bearing cap bolt threads, install and tighten bolts progressively in sequence shown in (Fig. 90) to 94 N·m (69 ft. lbs.).

(10) Check crankshaft end play by performing the following:

(a) Mount a dial indicator to front of engine; locating probe on nose of crankshaft (Fig. 91).

(b) Move crankshaft all the way to the rear of its travel.

(c) Zero the dial indicator.

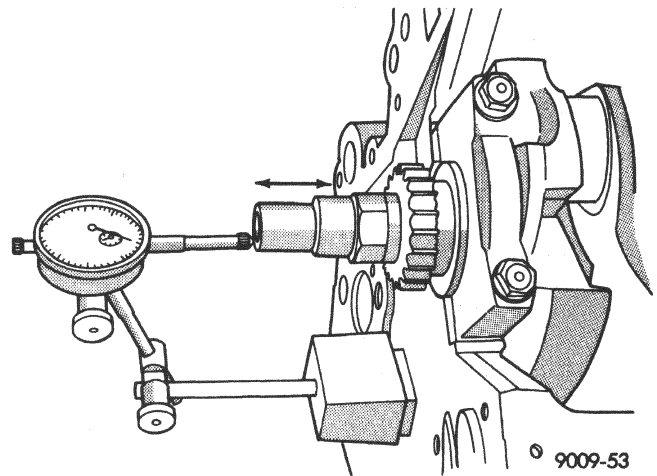
(d) Move crankshaft all the way to the front and read the dial indicator. Refer to Engine Specifications.

(11) Lubricate connecting rod bearings with engine oil. Install connecting rod caps in original position. Tighten connecting rod cap nuts to 52 N·m (38 ft. lbs.).

(12) Install oil pump assembly.

(13) Install oil pan.

(14) Install rear oil seal and retainer.

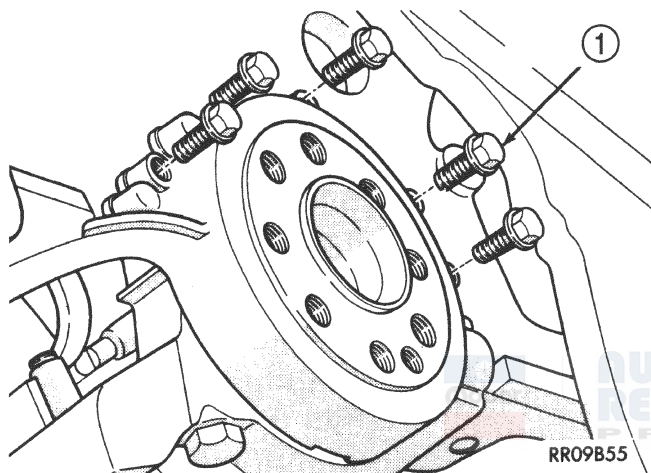
**Fig. 91 Crankshaft End Play—Typical**

(15) Install flex plate. Apply Mopar® Lock & Seal Adhesive to bolt threads and tighten to 95 N·m (70 ft. lbs.).

(16) Install engine assembly.

**REMOVAL AND INSTALLATION (Continued)****CRANKSHAFT OIL SEAL AND RETAINER—REAR****REMOVAL**

- (1) Remove transaxle from vehicle. Refer to Group 21, Transaxle for procedure.
- (2) Remove flex plate.
- (3) Remove oil pan. Refer to procedure in this section.
- (4) Remove bolts attaching oil seal retainer to cylinder block (Fig. 92).
- (5) Remove oil seal and retainer.
- (6) Remove oil seal from retainer.

**Fig. 92 Crankshaft Oil Seal Retainer—Rear**

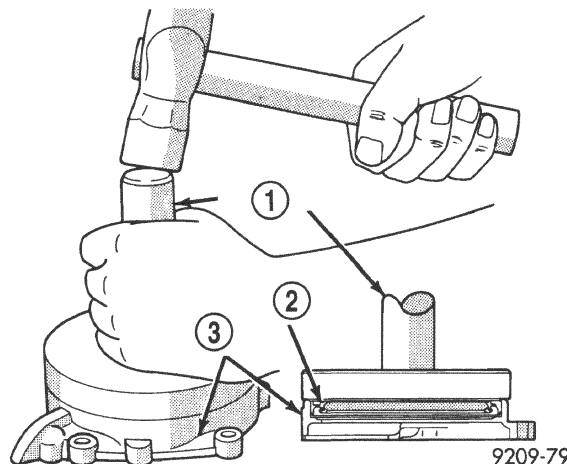
1 - 10mm (104 IN. LBS.)

**INSTALLATION**

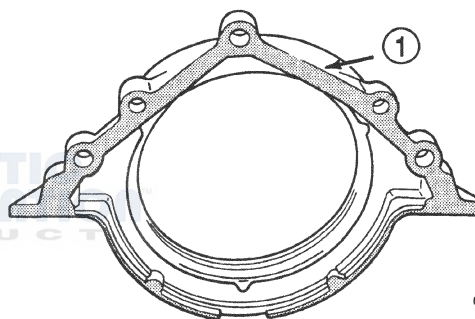
- (1) Inspect and clean all sealing surfaces.
- (2) Install rear crankshaft oil seal in housing with Special Tool MD-998718 (Fig. 93).
- (3) Apply Mopar® RTV GEN II Silicone Rubber Adhesive to the oil seal retainer housing (Fig. 94).
- (4) Apply light coating of engine oil to the entire circumference of oil seal lip.
- (5) Install seal assembly on cylinder block and tighten bolts to 11 N·m (104 in. lbs.).
- (6) Install oil pan. Refer to procedure in this section.
- (7) Install flex plate. Apply Mopar® Lock & Seal Adhesive to bolt threads and tighten to 95 N·m (70 ft. lbs.).
- (8) Install transaxle. Refer to Group 21, Transaxle for procedure.

**ENGINE CORE PLUGS****REMOVAL**

Using a blunt tool such as a drift or a screwdriver and a hammer, strike the bottom edge of the cup

**Fig. 93 Install Crankshaft Rear Oil Seal**

- 1 - SPECIAL TOOL MD-998718  
2 - SEAL  
3 - HOUSING

**Fig. 94 Apply Sealant to Oil Seal Housing**

- 1 - MOPAR SILICONE RUBBER ADHESIVE SEALANT

plug (Fig. 95). With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 95).

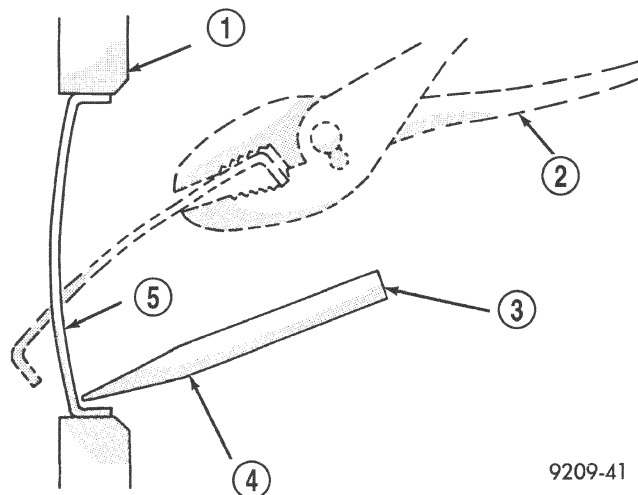
**CAUTION:** Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

**INSTALLATION**

Thoroughly clean all debris/rust from inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount Adhesive. Make certain the new plug is cleaned of all oil or grease. Using a proper driver, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 inch.) inside the lead in chamfer (Fig. 95).

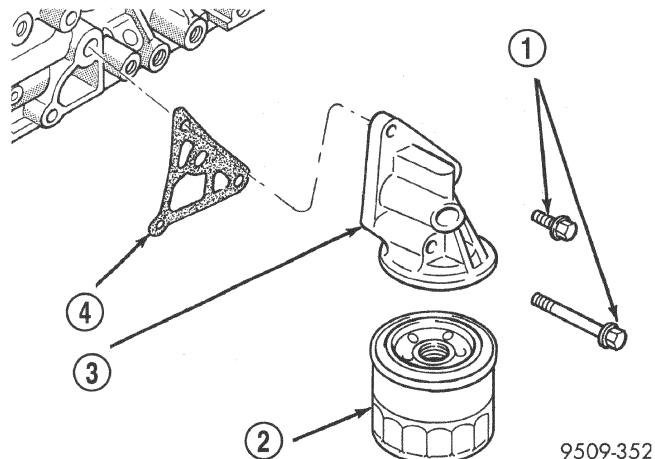
It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

## REMOVAL AND INSTALLATION (Continued)



**Fig. 95 Core Hole Plug Removal**

- 1 - CYLINDER BLOCK
- 2 - SECOND REMOVE PLUG WITH PLIERS
- 3 - FIRST STRIKE HERE WITH HAMMER
- 4 - DRIFT
- 5 - CUP PLUG



**Fig. 96 Oil Filter and Bracket**

- 1 - 23 N·m (17 IN. LBS.)
- 2 - FILTER
- 3 - BRACKET
- 4 - GASKET

## OIL FILTER

**CAUTION:** When servicing the oil filter (Fig. 96), avoid deforming the filter can by installing the remove/install tool band strap against the can-to-base lock seam. The lock seam joining the can to the base is reinforced by the base plate.

### REMOVAL

- (1) Turn filter counterclockwise to remove.

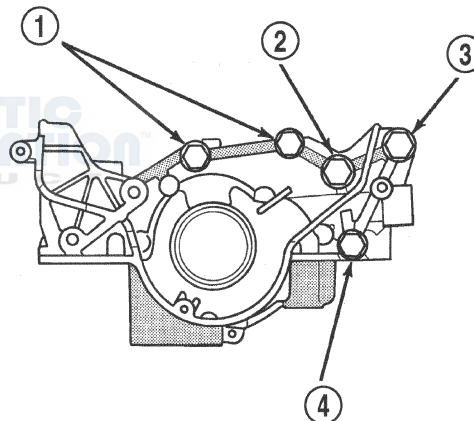
### INSTALLATION

- (1) Lubricate new filter gasket.
- (2) Screw filter on until gasket contacts base. Tighten to 14 N·m (10 ft. lbs.).

## OIL PUMP

### REMOVAL

- (1) Remove accessory drive belts. Refer to Group 7, Cooling System for procedure.
- (2) Refer to procedures in this section for removing the following components:
  - Oil Pan
  - Crankshaft Damper
  - Timing Belt Covers
  - Timing Belt
- (3) Remove crankshaft sprocket and key.
- (4) Remove oil pickup tube.
- (5) Remove bolts that attach oil pump to block (Fig. 97).



**Fig. 97 Oil Pump Assembly**

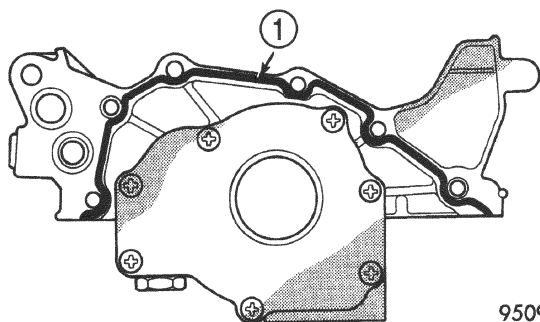
- 1 - M8 × 25 MM (1 IN.)
- 2 - M8 × 30 MM (1 3/16 IN.)
- 3 - M10 × 50 MM (1 31/32 IN.)
- 4 - M8 × 60 MM (2 3/8 IN.)

### INSTALLATION

- (1) Clean block and pump sealing surfaces.
- (2) Prime oil pump before installation by filling rotor cavity with clean engine oil.
- (3) Apply Mopar® Gasket Maker to oil pump as shown in (Fig. 98). Install oil-ring into the counter bore on the oil pump body discharge passage.
- (4) Install oil pump slowly onto crankshaft until seated to engine block. Tighten fasteners to M8 bolts 14 N·m (10 ft. lbs.) M10 bolts 41 N·m (30 ft. lbs.). See (Fig. 97) for bolt location and length.
- (5) Install oil pickup tube. Tighten fasteners to 19 N·m (168 in. lbs.).



## REMOVAL AND INSTALLATION (Continued)



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**Fig. 98 Oil Pump Sealing**

1 - .118 in. (3 mm) OF SEALANT

- (6) Install crankshaft sprocket and key.  
 (7) Refer to procedures in this section for installing the following components:

- Timing Belt
- Timing Belt Covers
- Crankshaft Damper
- Oil Pan

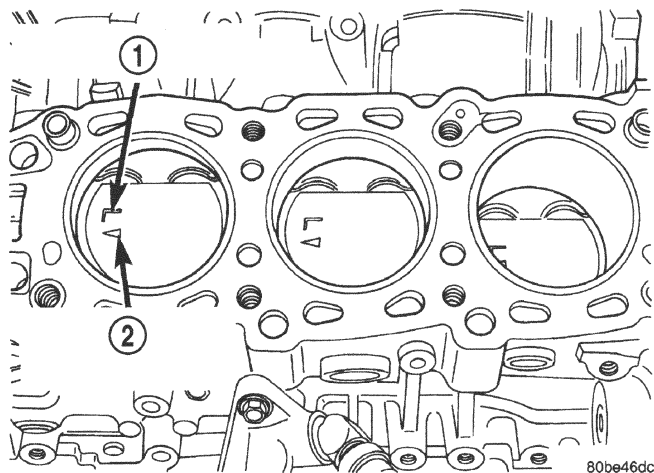
(8) Install accessory drive belts. Refer to Group 7, Cooling System for procedure.

## PISTON AND CONNECTING ROD

## REMOVAL

(1) Remove oil pan and cylinder head(s). Refer to procedures in this section.

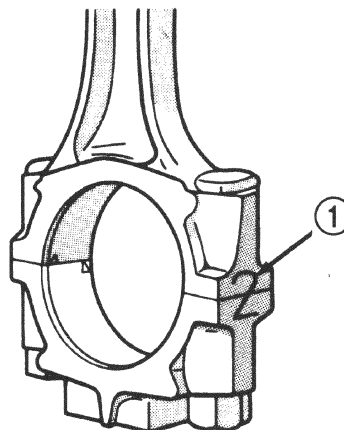
(2) Identify pistons with matching cylinder. **The pistons are not interchangeable from bank to bank** (Fig. 99). Pistons with the letter R and arrow toward the front of engine are to be installed in cylinders 1-3-5. Pistons with the letter L and arrow toward the front of engine are to be installed in cylinders 2-4-6.



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**Fig. 99 Piston Markings**

- 1 - "L" FORWARD FOR CYLINDERS 2-4-6  
 2 - ARROW FACE TOWARD FRONT OF ENGINE

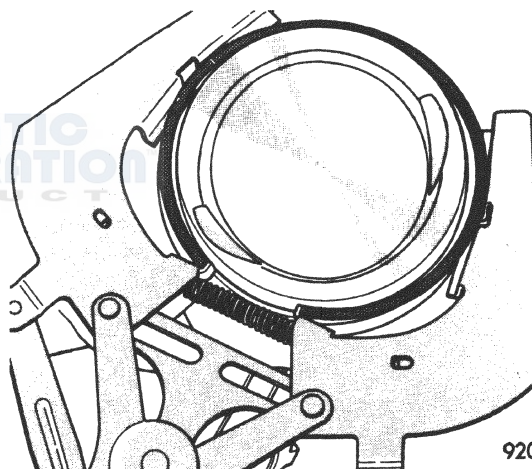


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**Fig. 100 Mark Matching Parts**

1 - CYLINDER NUMBER

(3) Mark connecting rod and cap with cylinder number (Fig. 100).



9209-16

**Fig. 101 Piston Ring—Removal**

(4) Remove piston rings (Fig. 101).

## INSTALLING PISTON RINGS

(1) The No. 1 and No. 2 piston rings have a different cross section. Install rings with manufacturers mark and size mark facing up, to the top of the piston (Fig. 102).

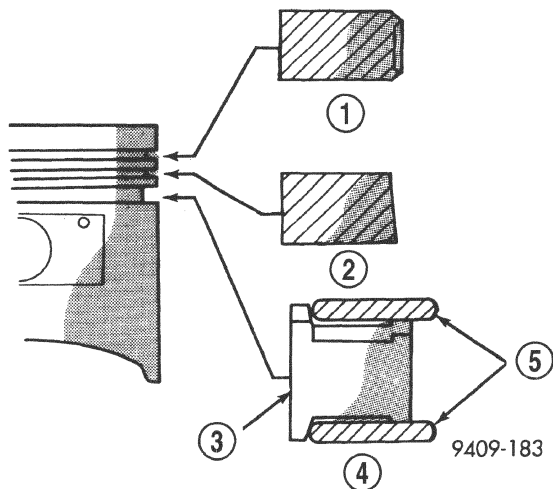
**CAUTION:** Install piston rings in the following order:

- a. Oil ring expander.
- b. Upper oil ring side rail.
- c. Lower oil ring side rail.
- d. No. 2 Intermediate piston ring.
- e. No. 1 Upper piston ring.

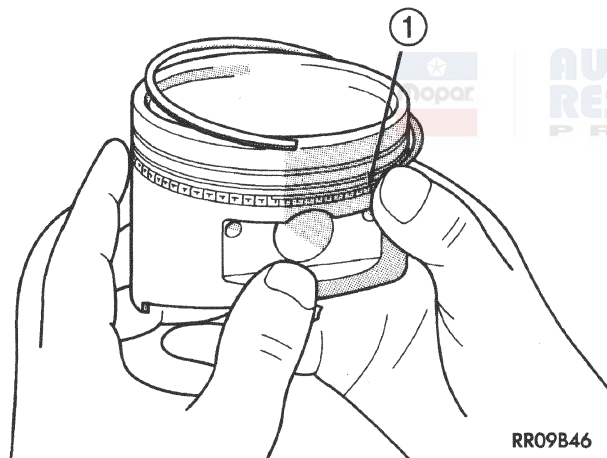
(2) Install the side rails (upper rail first, then lower rail) by placing one end between the piston



## REMOVAL AND INSTALLATION (Continued)

**Fig. 102 Piston Ring—Installation**

- 1 - NO. 1 PISTON RING
- 2 - NO. 2 PISTON RING
- 3 - SPACER EXTENDER
- 4 - OIL RING
- 5 - SIDE RAIL

**Fig. 103 Side Rail—Installation**

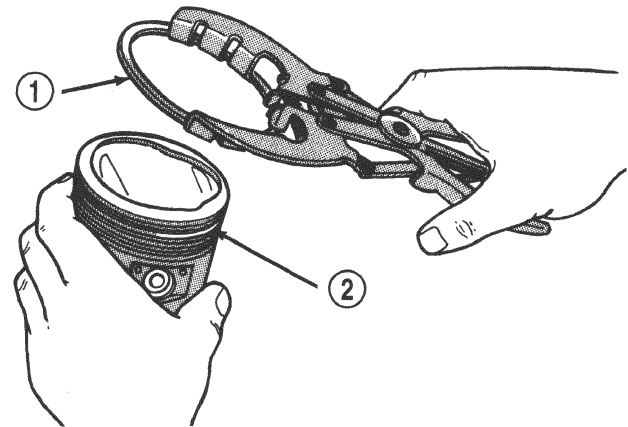
- 1 - SIDE RAIL END

ring groove and the expander. Hold end firmly and press down the portion to be installed until side rail is in position. **Do Not use a piston ring expander** (Fig. 103).

(3) Using a piston ring expander, install No. 2 piston ring and then No. 1 piston ring (Fig. 104).

(4) Position piston ring end gaps as shown in (Fig. 105).

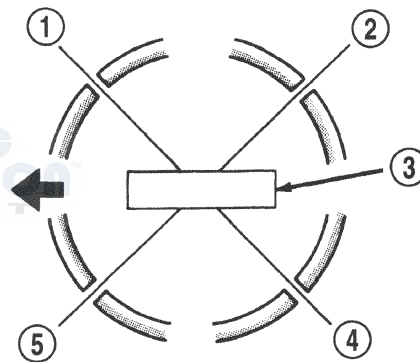
(5) Position oil ring expander gap at least 45° from the side rail gaps but **not** on the piston pin center or on the thrust direction.



9109-105

**Fig. 104 Upper and Intermediate Ring—Installation**

- 1 - NO. 1 RING
- 2 - NO. 2 RING - INSTALL FIRST



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**Fig. 105 Piston Ring End Gap Position**

- 1 - SIDE RAIL UPPER
- 2 - NO. 1 RING GAP
- 3 - PISTON PIN
- 4 - SIDE RAIL LOWER
- 5 - NO. 2 RING GAP AND SPACER EXPANDER GAP

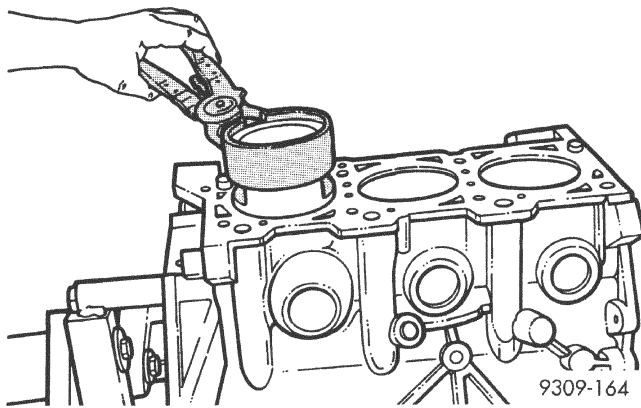
**INSTALLATION**

(1) Before installing pistons and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 105).

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston and tighten. **Be sure position of rings does not change during this operation.**

(4) Install connecting rod bolt protectors on rod bolts.

**REMOVAL AND INSTALLATION (Continued)****Fig. 106 Piston—Installation**

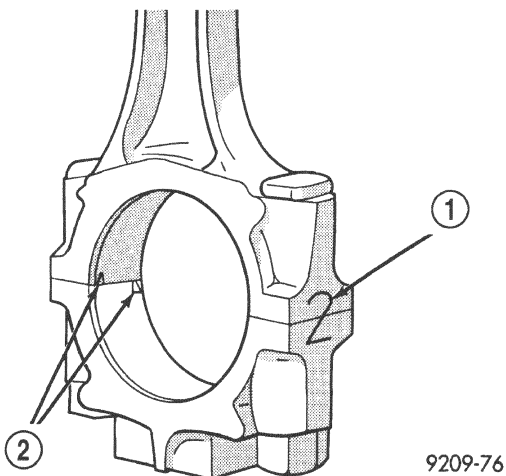
(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert rod and piston into cylinder bore and guide rod over the crankshaft journal.

(6) Install the piston and connecting rod assembly with the directional letter is located on the top of the piston with the arrow facing toward the camshaft sprocket.

(7) Tap the piston down in cylinder bore, using a hammer handle. At the same time, guide connecting rod into position on connecting rod journal (Fig. 106).

(8) Install rod caps. Install nuts on cleaned and oiled rod bolts and tighten nuts to 52 N·m (38 ft. lbs.).

**CAUTION:** Piston assemblies are not to be interchanged from bank to bank.

**Fig. 107 Connecting Rod and Cap**

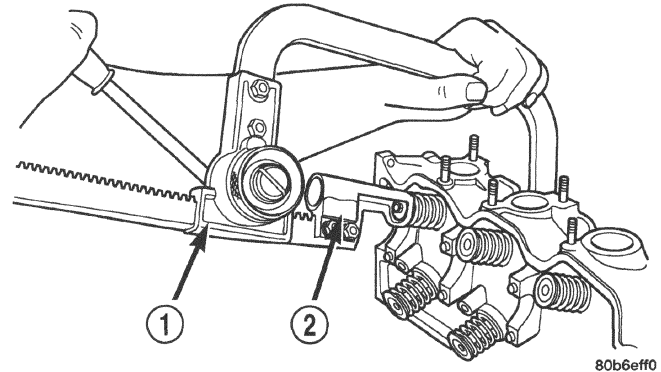
- 1 - CYLINDER NUMBER  
2 - NOTCHES TO HOLD BEARING

(9) Check alignment marks made during disassembly and that bearing position notches new or used are on the same side as shown in (Fig. 107).

(10) Install cylinder head(s) and oil pan. Refer to procedures in this section.

**DISASSEMBLY AND ASSEMBLY****CYLINDER HEAD****DISASSEMBLY**

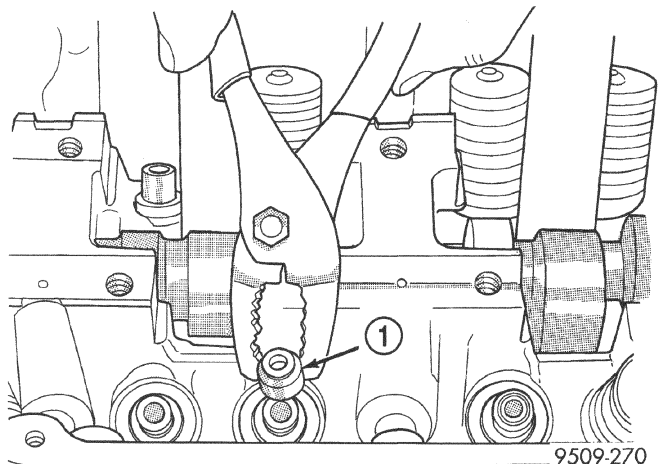
**CAUTION:** Before disassembly, mark each valve's position on the face of each valve being removed. The valves must be reinstalled into the same position.

**Fig. 108 Valve Removal**

- 1 - SPECIAL TOOL: C-3422-B  
2 - SPECIAL TOOL: 6526

(1) With valve spring compressor Special Tool C-3422-B with adapter 6526 or equivalent, remove spring retainer locks, retainer, valve spring, and valve (Fig. 108).

(2) Remove valve stem seals with suitable tool (Fig. 109). Do not reuse valve stem seals.

**Fig. 109 Valve Stem Seals—Removal**

- 1 - VALVE STEM SEAL

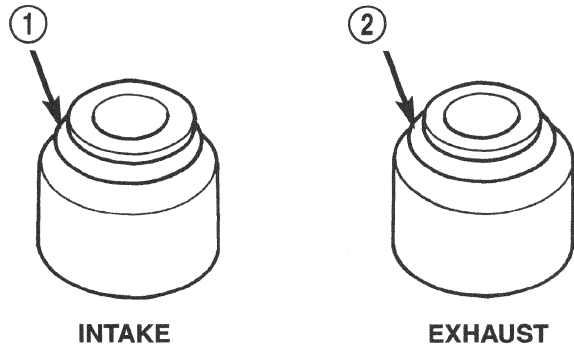
**ASSEMBLY**

(1) Coat valve stems with clean engine oil and insert valve in cylinder head in original position, if being reused.

## DISASSEMBLY AND ASSEMBLY (Continued)

(2) Install valve spring seat.

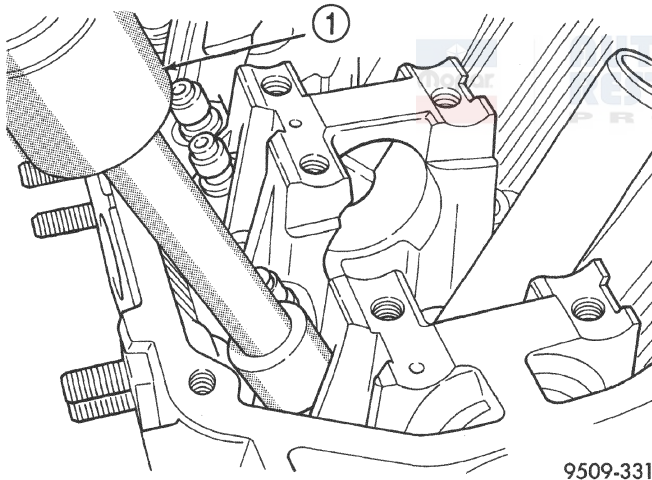
(3) Install the "gray" valve seal onto the intake valve and the "grayish green" seal onto the exhaust valve (Fig. 110). Using Special Tool MD-998774 install seal by tapping lightly until seal is in place (Fig. 111).



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**Fig. 110 Valve Stem Seals Identification**

- 1 - GRAY
- 2 - GRAYISH GREEN

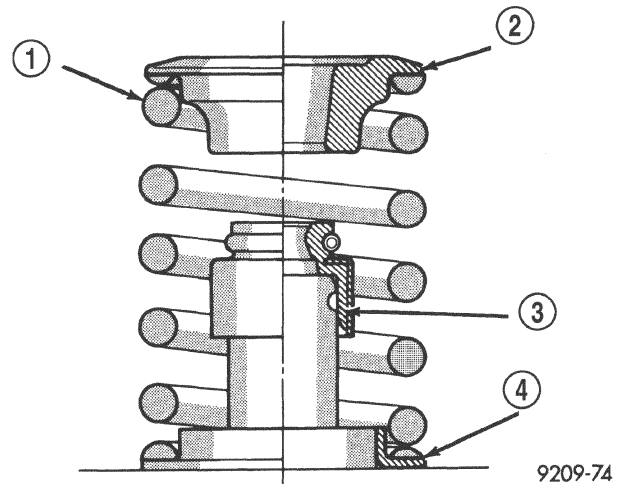


**Fig. 111 Valve Stem Seals—Installed**

- 1 - SPECIAL TOOL MD998774

(4) Install valve spring with the enamelled ends facing the rocker arms (Fig. 112). Install valve springs and retainers. Compress valve springs only enough to install locks, taking care not to misalign the direction of compression. Nicked valve stems may result from misalignment of the valve spring compressor.

**CAUTION:** When depressing the valve spring retainers with valve spring compressor the locks can become dislocated. Check to make sure both locks are in their correct location after removing tool.

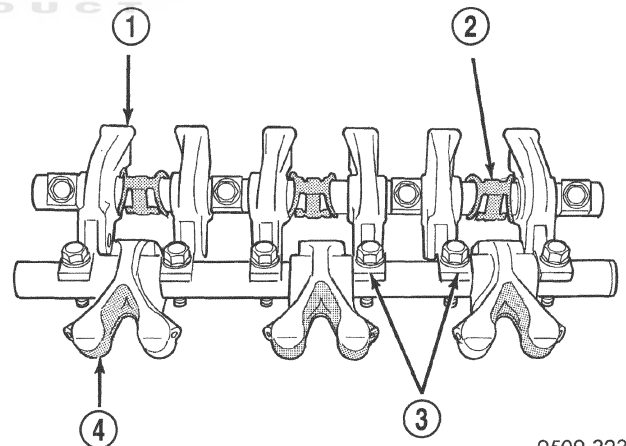


**Fig. 112 Valve Spring Position—Installed**

- 1 - ENAMELED END
- 2 - SPRING RETAINER
- 3 - STEM SEAL
- 4 - SPRING SEAT

## ROCKER ARMS

(1) Identify the rocker arms and retainers for reassembly. Disassemble the rocker arm assemblies by removing the attaching bolts and spring clips from the shaft (Fig. 113).



**Fig. 113 Rocker Arm Shafts**

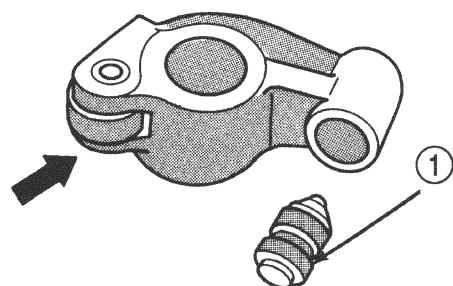
- 1 - INTAKE ROCKER ARMS
- 2 - ROCKER SHAFT SPRINGS
- 3 - ROCKER ARM SHAFT RETAINERS
- 4 - EXHAUST ROCKER ARMS

(2) Slide the rocker arms off the shaft. Keep the spacers and rocker arms in the same location for reassembly.

## INSPECTION

Inspect the rocker arm for scoring, wear of the roller or damage to the rocker arm (Fig. 114). Replace as necessary.



**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 114 Rocker Arm**

1 - AUTO-LASH ADJUSTER

**ROCKER ARM SHAFTS**

The rocker arm shafts is hollow and is used as a lubrication oil duct.

(1) Check the rocker arm mounting portion of the shafts for wear or damage. Replace if damaged or worn.

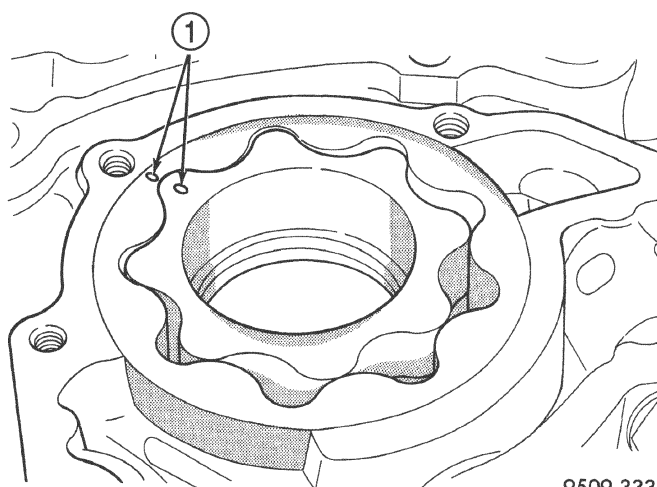
(2) Check oil holes for clogging with small wire, clean as required.

**REASSEMBLY**

Lubricate the rocker arms. Install onto shafts in their original position (Fig. 113).

**OIL PUMP**

(1) Assemble pump, using new parts as required with clean oil. Align marks on the inner and outer rotors when assembling (Fig. 115).



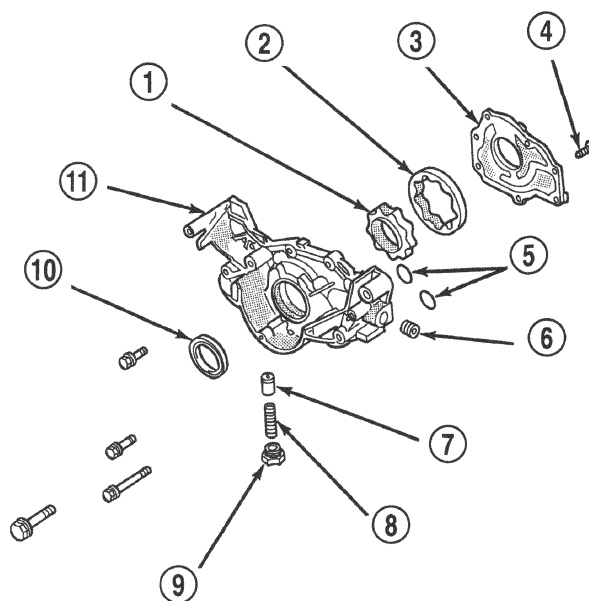
9509-333

**Fig. 115 Inner and Outer Rotor Alignment Marks**

1 - ALIGNMENT MARKS

(2) Install cover and tighten screws to 10 N·m (85 in. lbs.).

(3) Install relief valve, spring, gasket and cap as shown in (Fig. 116). Tighten cap to 44 N·m (33 ft. lbs.)



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**Fig. 116 Oil Pump**

- 1 - INNER ROTOR
- 2 - OUTER ROTOR
- 3 - PUMP COVER
- 4 - SCREW
- 5 - O-RINGS
- 6 - PLUG
- 7 - OIL PRESSURE RELIEF VALVE
- 8 - RELIEF VALVE SPRING
- 9 - PLUG
- 10 - SEAL
- 11 - OIL PUMP BODY

**CLEANING AND INSPECTION****INTAKE MANIFOLD****CLEANING**

Discard gasket and clean all gasket surfaces of manifold to cylinder heads.

**INSPECTION**

Check upper and lower manifold gasket surfaces for flatness with straight edge. Surface must be flat within 0.15 mm per 300 mm (0.006 in. per foot) of manifold length.

Inspect manifolds for cracks or distortion. Replace manifold if necessary.

**EXHAUST MANIFOLD****CLEANING**

Clean sealing surfaces of manifold and cylinder head.



## CLEANING AND INSPECTION (Continued)

### INSPECTION

Inspect exhaust manifolds for damage or cracks. Check distortion of the cylinder head mounting surface and exhaust crossover mounting surface with a straightedge and thickness gauge.

### CAMSHAFT

#### CLEANING

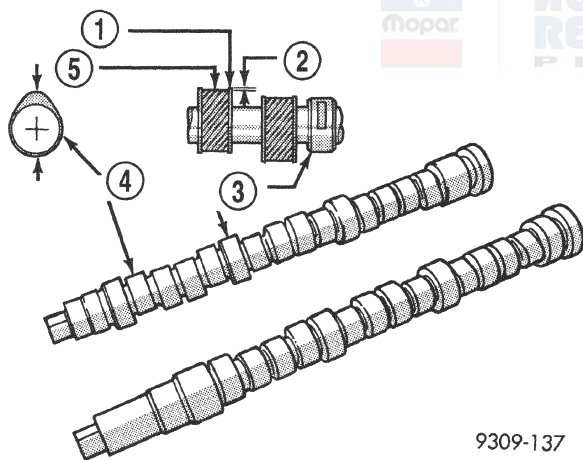
Clean camshaft with a suitable solvent.

#### INSPECTION

Check oil feed holes for blockage.

Inspect cylinder head journals for wear.

Check camshaft bearing journals for scratches and worn areas (Fig. 117). If light scratches are present, they may be removed with 400 grit sand paper. If deep scratches are present, replace the camshaft and check the cylinder head for damage. Replace the cylinder head if worn or damaged. Check the lobes for pitting and wear. If the lobes show signs of wear, check the corresponding rocker arm roller for wear or damage. Replace rocker arm if worn or damaged. If lobes show signs of pitting on the nose, flank or base circle; replace the camshaft.



**Fig. 117 Checking Camshafts for Wear**

- 1 - UNWORN AREA - MIKE HERE
- 2 - ACTUAL WEAR
- 3 - BEARING JOURNAL
- 4 - LOBE
- 5 - WEAR ZONE - MIKE HERE

## CYLINDER BORE AND BLOCK

#### CLEANING

Clean cylinder block using a suitable solvent.

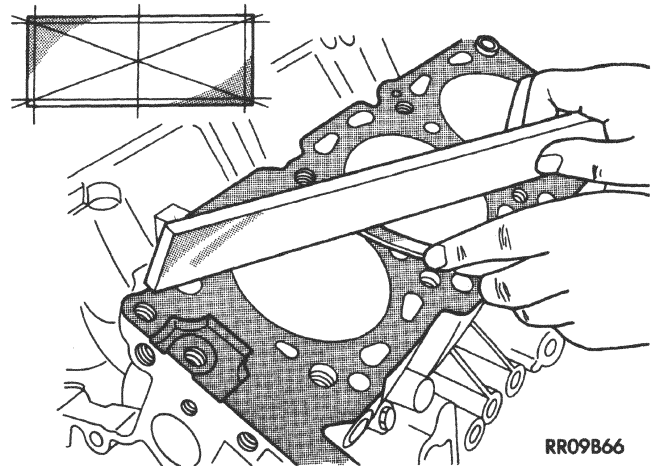
#### CYLINDER BLOCK INSPECTION

Inspect cylinder block for scratches, cracks and rust or corrosion, and repair or replace as required.

(1) Clean cylinder block and check top surface for distortion with a straight edge and thickness gauge (Fig. 118).

(2) Top surface must be flat within:

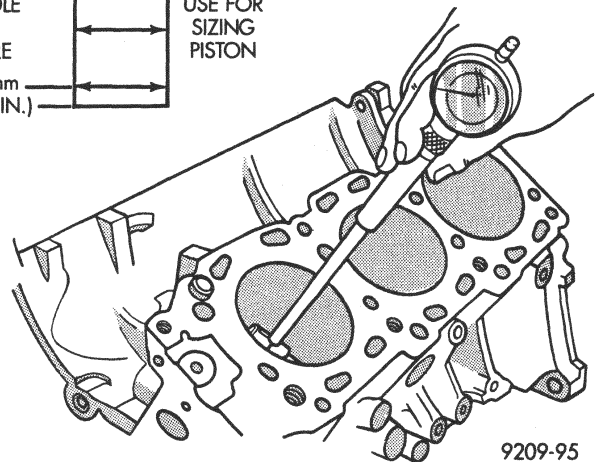
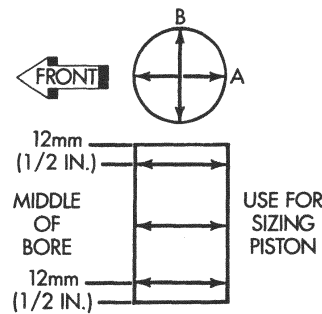
- Standard Value: 0.05 mm (0.002 in.)
- Service Limit 0.1 mm (0.0039 in.)



**Fig. 118 Distortion Check**

#### CYLINDER BORE INSPECTION

(1) Measure the cylinder bore at three levels in directions A and B (Fig. 119). Top measurement should be 12 mm (0.50 in.) down and bottom measurement should be 10 mm (0.38 in.) up.



**Fig. 119 Checking Cylinder Bore Size**

(2) Standard bore dimension: 83.50 - 83.53 mm (3.2874- 3.2886 in.)

(3) Maximum out-of-round or taper: 0.01 mm (0.0004 in.)

**CLEANING AND INSPECTION (Continued)****CYLINDER HEAD****CLEANING**

Clean cylinder head and oil passages using a suitable solvent.

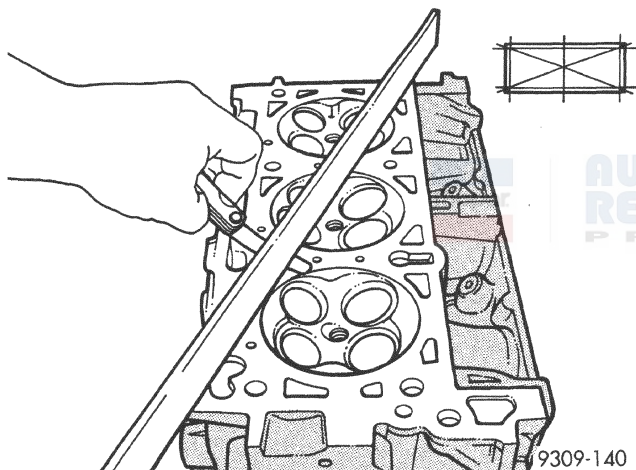
**INSPECTION****CYLINDER HEAD**

Check cylinder head for flatness (Fig. 120).

Cylinder head must be flat within:

- Standard dimension: less than 0.03 mm (0.0012 inch)
- Service Limit: 0.2 mm (0.008 inch)
- Grinding Limit: Maximum of 0.2 mm (0.008 inch) is permitted.

**CAUTION:** This is a combined total dimension of stock removal from cylinder head if any and block top surface is 0.2 mm (0.0079 in.).



**Fig. 120 Checking Cylinder Head Flatness**

**VALVE GUIDES**

Remove carbon and varnish deposits from inside of valve guides with a reliable guide cleaner.

Using a small hole gauge and a micrometer, measure valve guides in 3 places top, middle and bottom (Fig. 121). Refer to Engine Specifications. Replace guides if they are not within specification.

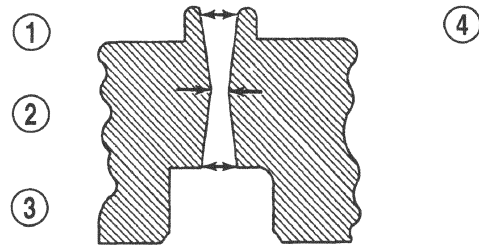
Check valve guide height (Fig. 122).

**CYLINDER HEAD COVER****CLEANING**

Clean cylinder head and cover mating surfaces using a suitable solvent.

**INSPECTION**

Inspect cover rails for flatness.

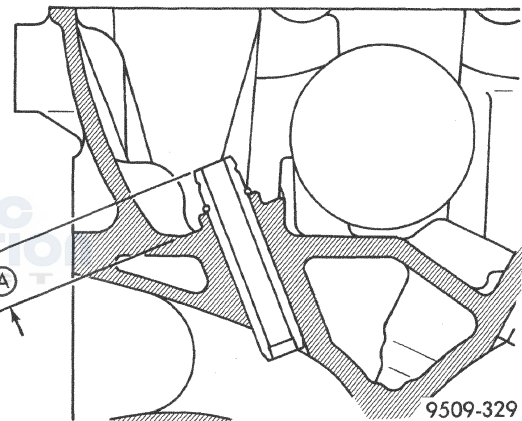


9109-98

**Fig. 121 Checking Wear on Valve Guide—Typical**

- 1 - TOP
- 2 - MIDDLE
- 3 - BOTTOM
- 4 - CUT AWAY VIEW OF VALVE GUIDE MEASUREMENT LOCATIONS

(A) 14.0 mm



9509-329

**Fig. 122 Valve Guide Height**

**ROCKER ARM AND AUTO LASH ADJUSTER****CLEANING**

The automatic lash adjusters are precision units installed in machined openings in the valve actuating ends of the rocker arms. Do not disassemble the auto lash adjuster.

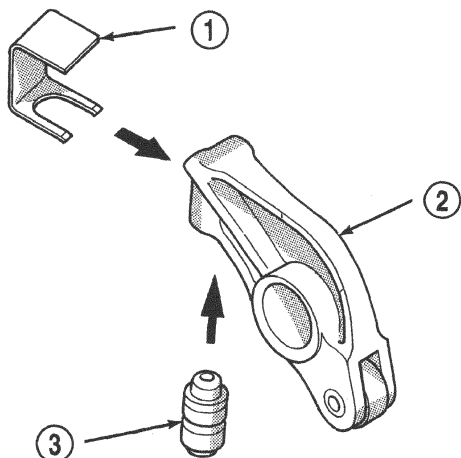
Remove lash adjuster from rocker arm. Clean rocker arm using a suitable solvent.

**INSPECTION**

Inspect the rocker arm and hydraulic lash adjuster assembly for wear or damage (Fig. 123). Replace as necessary.

**OIL FILTER BRACKET****CLEANING**

Remove gasket and clean bracket using a suitable solvent.

**CLEANING AND INSPECTION (Continued)**

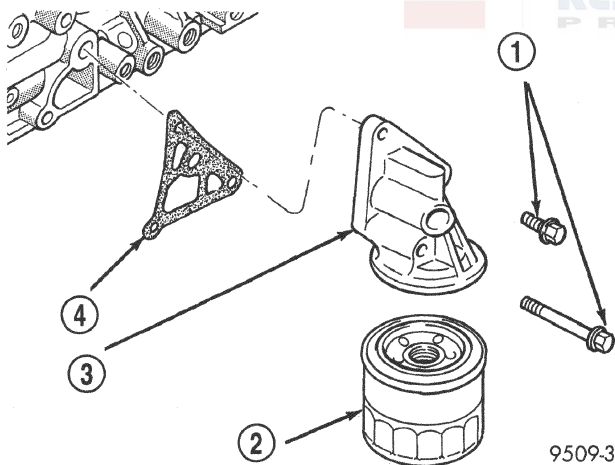
9509-321

**Fig. 123 Rocker Arm/Hydraulic Lash Adjuster Assemblies**

- 1 - SPECIAL TOOL MD998443
- 2 - ROLLER ROCKER ARM
- 3 - HYDRAULIC LASH ADJUSTER

**INSPECTION**

Check the oil filter mounting surface. The surface must be smooth, flat and free of debris or old pieces of rubber (Fig. 124). Check bracket for cracks and oil leaks.



9509-352

**Fig. 124 Oil Filter and Bracket**

- 1 - 23 N·m (17 IN. LBS.)
- 2 - FILTER
- 3 - BRACKET
- 4 - GASKET

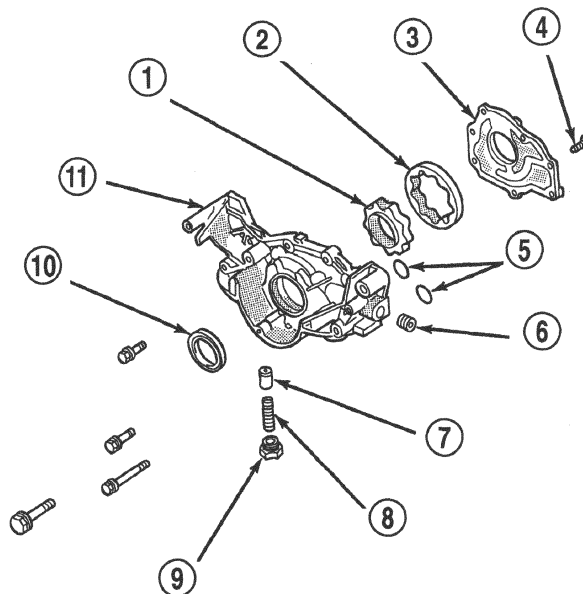
**OIL PUMP****CLEANING**

Disassemble oil pump and clean all components using a suitable solvent.

**INSPECTION**

(1) Check oil pump case for damage and remove rear cover.

(2) Remove pump rotors and inspect case for excessive wear (Fig. 125).



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**Fig. 125 Oil Pump Components**

- 1 - INNER ROTOR
- 2 - OUTER ROTOR
- 3 - PUMP COVER
- 4 - SCREW
- 5 - O-RINGS
- 6 - PLUG
- 7 - OIL PRESSURE RELIEF VALVE
- 8 - RELIEF VALVE SPRING
- 9 - PLUG
- 10 - SEAL
- 11 - OIL PUMP BODY

(3) Insert the rotor into the oil pump case (Fig. 126) and measure clearance with a feeler gauge as indicated. Replace if out of limits.

(4) Using a feeler gauge, measure clearance between inner rotor tip and outer rotor (Fig. 127). Clearance specification is: 0.06 - 0.18 mm (0.0024 - 0.0071 in.). Replace if out of limits.

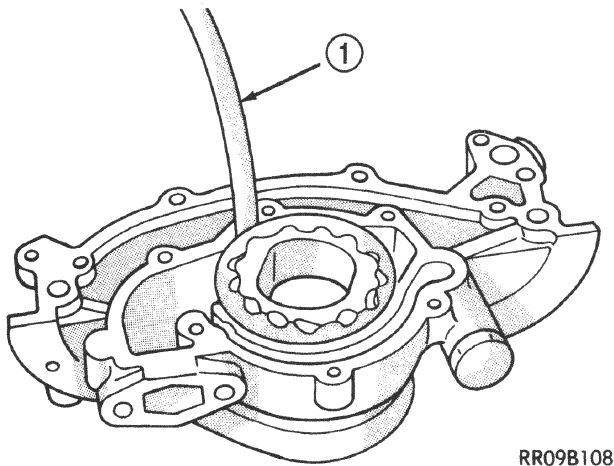
(5) Place a straightedge across face of pump housing (Fig. 128). Clearance should be between 0.04 - 0.10 mm (0.0015 - 0.0039 in.). Replace if out of limits.

**OIL RELIEF PLUNGER**

(1) Check that the oil relief plunger slides smoothly (Fig. 125).

(2) Check for broken relief spring.

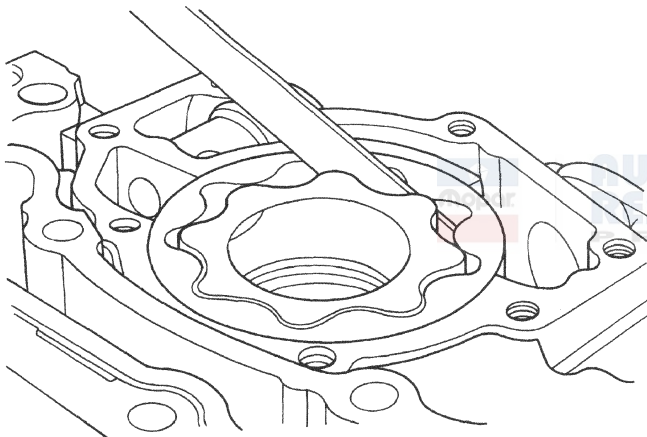


**CLEANING AND INSPECTION (Continued)**

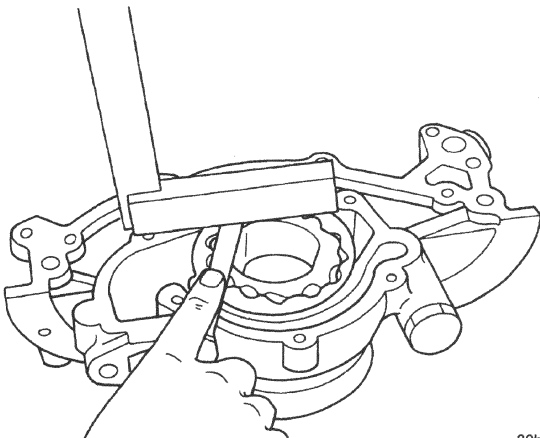
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**Fig. 126 Checking Clearance-Between Outer Rotor and Case**

1 - 0.10 TO 0.18 mm (0.004 TO 0.007 INCH)



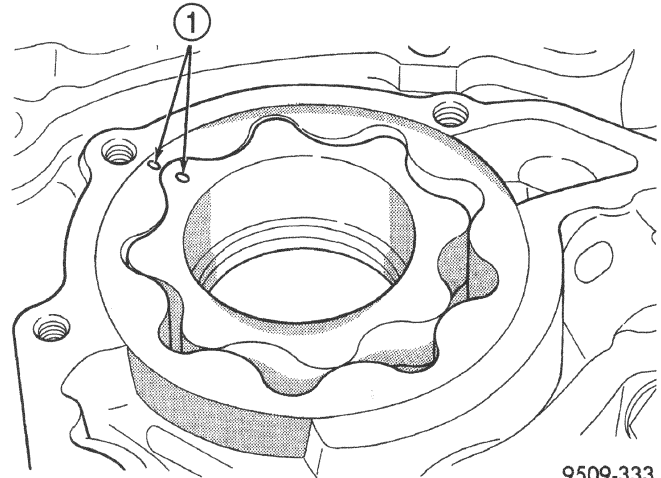
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**Fig. 127 Measuring Clearance Between Rotors**

80b01d0a

**Fig. 128 Measuring Clearance Over Rotors****OIL PUMP ASSEMBLY**

(1) Assemble pump, using new parts as required with clean oil. Align marks on the inner and outer rotors when assembling (Fig. 129).



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**Fig. 129 Inner and Outer Rotor Alignment Marks**

1 - ALIGNMENT MARKS

(2) Install cover and tighten screws to 12 N·m (105 in. lbs.)

(3) Install relief valve, spring, gasket and cap as shown in (Fig. 125). Tighten cap to 41 N·m (30 ft. lbs.)

**TIMING BELT****CLEANING**

Do Not attempt to clean a timing belt. If contamination from oil, grease, or coolants have occurred, the timing belt should be replaced.

Clean all sprockets using a suitable solvent. Clean all sprocket grooves of any debris.

**INSPECTION**

(1) Remove the upper left timing belt cover (Fig. 130).

(2) Inspect both sides of the timing belt drive & back. Replace belt if any of the following conditions exist.

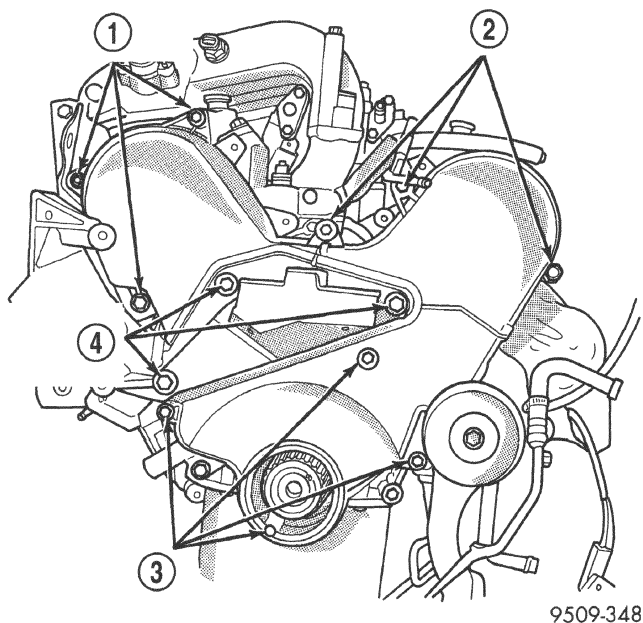
- Hardening of back rubber back side is glossy without resilience and leaves no indent when pressed with fingernail.

- Cracks on rubber back.
- Cracks or peeling of canvas.
- Cracks on rib root.
- Cracks on belt sides.
- Missing teeth.

- Contamination by oil, grease, or coolants.

- Abnormal wear of belt sides. The sides are normal if they are sharp as if cut by a knife (Fig. 131).



**CLEANING AND INSPECTION (Continued)****Fig. 130 Timing Belt Covers**

- 1 - UPPER RIGHT TIMING BELT COVER FASTENERS
- 2 - UPPER LEFT TIMING BELT COVER FASTENERS
- 3 - LOWER TIMING BELT COVER FASTENERS
- 4 - ENGINE BRACKET FASTENERS

(3) If none of the above conditions are seen on the belt, the belt cover can be reinstalled.

**VALVES, SPRINGS, SEATS AND GUIDES****CLEANING**

Clean components using a suitable solvent.

**INSPECTION**

(1) Check valve stem tip for pitting or depression at point A (Fig. 132).

(2) Check for wear and ridge wear at Point B.

(3) Measure the clearance between the valve guide and valve stem. If the service limit is exceeded, replace the valve guides, valves or both.

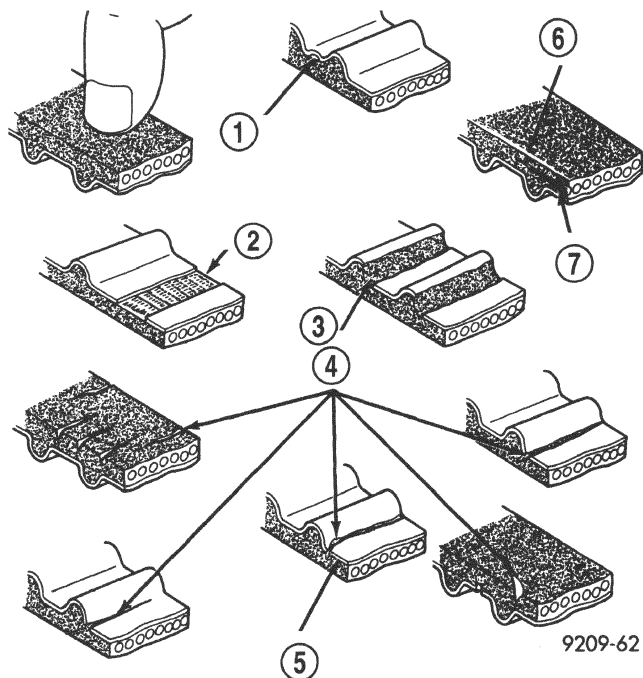
(4) Check for even contact (at face center) with valve seat, Point C.

(5) Check margin. Refer to Engine Specifications. Replace valve if margin is out of specification.

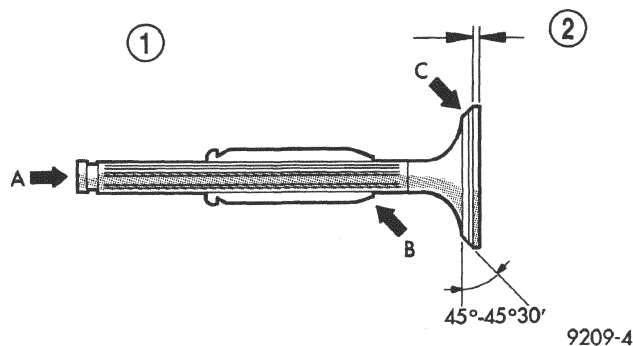
(6) Check valve guide height (Fig. 133).

(7) Measure valve stem to guide clearance. Refer to Engine Specifications.

(8) Measure valve spring free length and if the spring is square (Fig. 134). Refer to Engine Specifications.

**Fig. 131 Timing Belt Inspection**

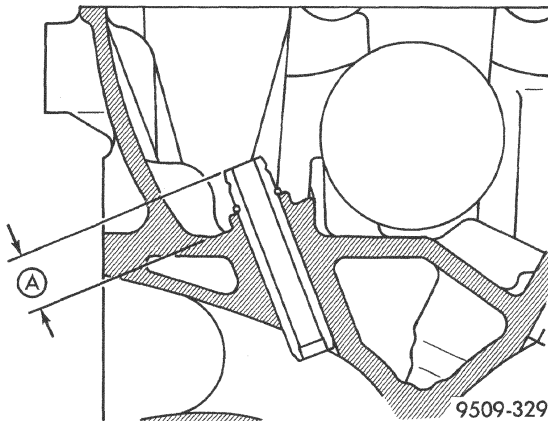
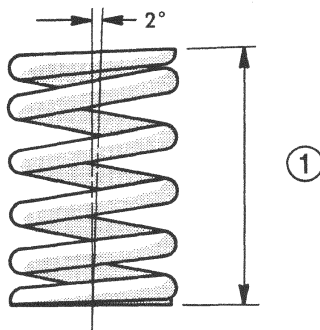
- 1 - PEELING
- 2 - TOOTH MISSING AND CANVAS FIBER EXPOSED
- 3 - RUBBER EXPOSED
- 4 - CRACKS
- 5 - PEELING
- 6 - ROUNDED EDGE
- 7 - ABNORMAL WEAR (FLUFFY STRAND)

**Fig. 132 Valve Inspection**

- 1 - C IS A SEAT CONTACT MARK AND IS NOT FULL WIDTH OF THE FACE
- 2 - MARGIN

**CLEANING AND INSPECTION (Continued)**

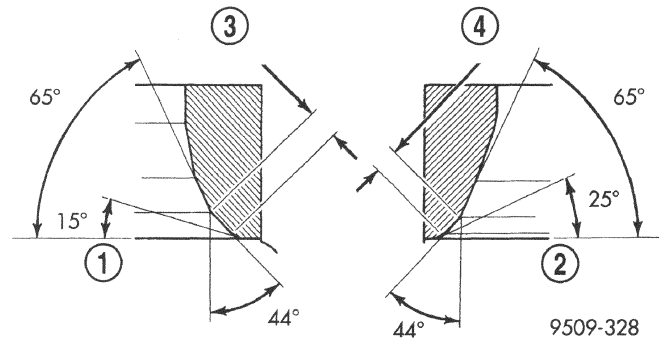
Ⓐ 14.0 mm

**Fig. 133 Valve Guide Height****Fig. 134 Valve Spring**

1 - LENGTH

**VALVE SEAT INSPECTION**

Inspect the valve seat with Prussian blue to determine where the valve contacts the seat. To do this, coat valve seat **LIGHTLY** with Prussian blue then set valve in place. Rotate the valve with light pressure. If the blue is transferred to the center of valve face, contact is satisfactory. If the blue is transferred to top edge of the valve face, lower valve seat with a 15 degrees stone. If the blue is transferred to the bottom edge of valve face raise valve seat with a 65 degree stone (Fig. 135).

**Fig. 135 Valve Seat Reconditioning**

- 1 - EXHAUST
- 2 - INTAKE
- 3 - 0.9-1.3mm (.035-.051 IN.)
- 4 - 0.9-1.3mm (.035-.051 IN.)

**ADJUSTMENTS****ENGINE SUPPORT ADJUSTMENT**

The right and left support assemblies are slotted to allow for right/left drive train adjustment in relation to drive shaft assembly length.

Check and reposition right and left engine support assemblies as required. Adjust drive train position, if required, for the following conditions:

- Drive shaft distress: See Group 2, Suspension and Driveshaft.
- Any front end structural damage (after repair).
- Support Assembly replacement.

**ENGINE SUPPORT ADJUSTMENT**

(1) Remove the load on the engine motor mounts by carefully supporting the engine and transmission assembly with a floor jack.

(2) Loosen the right engine support assembly vertical fasteners.

(3) Loosen the left engine support assembly vertical bolts.

(4) Pry the engine right or left as required to achieve the proper drive shaft assembly length. Refer to Group 2, Suspension and Driveshaft for driveshaft identification and related assembly length measuring.

(5) Tighten right engine support assembly vertical bolts to 61 N·m (45 ft. lbs.) and tighten left engine support assembly bolts to 61 N·m (45 ft. lbs.).

(6) Recheck drive shaft length.

## SPECIFICATIONS

### 2.5L ENGINE

DESCRIPTION	SPECIFICATION
<b>General Specification</b>	
Type	60° V-6 SOHC (Per Bank)
Number of Cylinders	6
Displacement	2.5 Liters (152 cu. in.)
Bore	83.5 mm (3.29 in.)
Stroke	76.0 mm (2.99 in.)
Compression Ratio	9.4:1 (Federal Emissions) 9.0:1 (California Emissions)
Firing Order	1-2-3-4-5-6
Compression Pressure (at 250–400 rpm)	1451 kPa (211 psi)
—(California Emission)	1393 kPa (202 psi)
Compression Pressure (Minimum)	1109 kPa (192 psi)
—(California Emission)	1059 kPa (154 psi)
Variation Between Cylinders (Maximum)	98 kPa (14 psi)
<b>Cylinder Block</b>	
Cylinder Bore Diameter	83.5–83.53 mm (3.2874–3.2886 in.)
Out-of-Round (Max.)	0.01 mm (0.0004 in.)
Taper (Max.)	0.01 mm (0.0004 in.)
Flatness of Top Surface	0.05 mm (0.002 in.)
Service Limit	0.1 mm (0.004 in.)
Grinding Limit*	0.2 mm (0.008 in.)
*Includes the combined surface grinding of cylinder head and block.	

DESCRIPTION	SPECIFICATION
<b>Pistons</b>	
Piston Diameter	83.5 mm (3.29 in.)
Clearance in Cylinder	0.02–0.04 mm (0.0008–0.0016 in.)
<b>Piston Pins</b>	
Press-in Load (at room temperature)	7350–17200 N (1652–3858 lbs.)
Diameter	22.0 mm (0.87 in.)
<b>Piston Rings</b>	
Ring Gap—Top Compression Ring	0.25–0.40 mm (0.0098–0.0157 in.)
Wear Limit	0.8 mm (0.031 in.)
Ring Gap—2nd Compression Ring	0.40–0.55 mm (0.0157–0.0217 in.)
Wear Limit	0.8 mm (0.031 in.)
Ring Gap—Oil Control Steel Rails	0.15–0.50 mm (0.0059–0.0197 in.)
Wear Limit	1.0 mm (0.039 in.)
Ring Side Clearance—Top Compression Ring	0.03–0.07 mm (0.0012–0.0028 in.)
Wear Limit	0.10 mm (0.004 in.)
Ring Side Clearance—2nd Compression Ring	0.02–0.06 mm (0.0008–0.0024 in.)
Wear Limit	0.10 mm (0.004 in.)
<b>Connecting Rod</b>	
Bearing Diametrical Clearance	0.02–0.05 mm (0.0008–0.0020 in.)
Wear Limit	0.10 mm (0.004 in.)
Side Clearance (big end)	0.10–0.25 mm (0.0039–0.0098 in.)
Wear Limit	0.40 mm (0.016 in.)



**SPECIFICATIONS (Continued)**

DESCRIPTION	SPECIFICATION
<b>Crankshaft</b>	
Connecting Rod Journal Diameter	50.0 mm (1.97 in.)
Main Bearing Journal Diameter	60.0 mm (2.362 in.)
Journal Out-of-Round (Max.)	0.03 mm (0.001 in.)
Journal Taper (Max.)	0.005 mm (0.0002 in.)
End Play	0.05–0.25 mm (0.002–0.0098 in.)
Wear Limit	0.3 mm (0.012 in.)
Main Bearing Diametrical Clearance	0.02–0.04 mm (0.0008–0.0016 in.)
Wear Limit	0.1 mm (0.004 in.)
<b>Camshaft</b>	
Journal Diameter	44.93 mm (1.7689 in.)
End Play	0.1–0.2 mm (0.004–0.008 in.)
Wear Limit	0.4 mm (0.0158 in.)
Intake Valve Timing*	
Closes (ABDC)	45°
Opens (BTDC)	19°
Exhaust Valve Timing*	
Closes (ATDC)	15°
Opens (BBDC)	49°
<b>Cylinder Head</b>	
Flatness of Gasket Surface	0.03 mm (0.0012 in.)
Service Limit	0.2 mm (0.008 in.)
Grinding Limit of Gasket Surface*	0.2 mm (0.008 in.)
*Includes the combined surface grinding of cylinder head and block.	

DESCRIPTION	SPECIFICATION
<b>Valve Seat</b>	
Angle	44–44.5°
Valve Seat Width—Intake and Exhaust	0.9–1.3 mm (0.035–0.051 in.)
<b>Valve Guide</b>	
Diameter—Inner	6.0 mm (0.236 in.)
Diameter—Outer (Std.)	11.0 mm (0.433 in.)
Guide Height (spring seat to guide tip)	14.0 mm (0.551 in.)
<b>Valves</b>	
Face Angle Intake and Exhaust	45–45.5°
Valve Length (Overall)—Intake	112.30 mm (4.4213 in.)
Service Limit	111.80 mm (4.4016 in.)
Valve Length (Overall)—Exhaust	114.11 mm (4.4925 in.)
Service Limit	113.61 mm (4.4728 in.)
Valve Stem Diameter—Intake and Exhaust	6.0 mm (0.236 in.)
<b>Valve Margin</b>	
Intake	1.0 mm (0.039 in.)
Service Limit	0.5 mm (0.019 in.)
Exhaust	1.2 mm (0.047 in.)
Service Limit	0.7 mm (0.028 in.)
<b>Valve Stem Tip Height</b>	
Intake and Exhaust	49.30 mm (1.9409 in.)
Service Limit	49.80 mm (1.9606 in.)



**SPECIFICATIONS (Continued)**

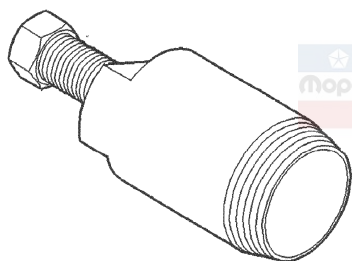
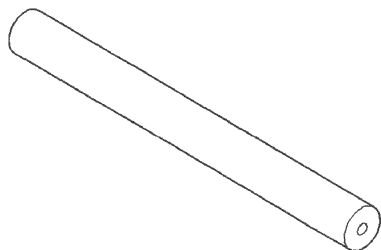
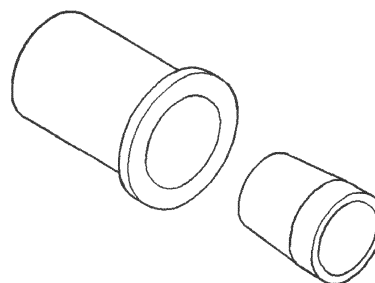
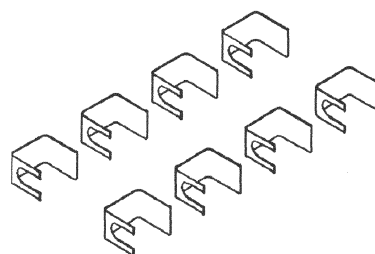
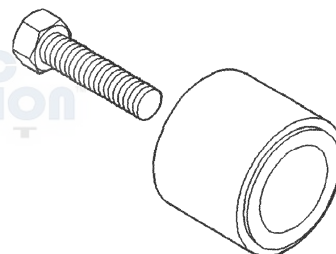
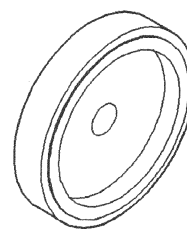
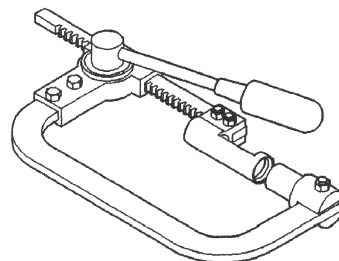
DESCRIPTION	SPECIFICATION
<b>Valve Stem to Guide Clearance</b>	
Intake	0.02–0.05 mm (0.0008–0.0020 in.)
Service Limit	0.10 mm (0.004 in.)
Exhaust	0.04–0.07 mm (0.0016–0.0028 in.)
Service Limit	0.15 mm (0.006 in.)
<b>Valve Springs</b>	
Free Height	51.0 mm (2.01 in.)
Service Limit	50.0 mm (1.97 in.)
Installed Height	44.2 mm (1.740 in.)
Spring Load at Installed Height	267 N (60 lbs.)
Out-of-Squareness	2° or less
Service Limit	4° Max.
<b>Oil Pump</b>	
Tip Clearance Between Rotors	0.06–0.18 mm (0.0024–0.0071 in.)
Clearance Over Rotors	0.04–0.10 mm (0.0015–0.0039 in.)
Outer Rotor to Case Clearance	0.10–0.18 mm (0.004–0.007 in.)
Service Limit	0.35 mm (0.0138 in.)
<b>Oil Pressure</b>	
At Curb Idle Speed and Engine at Operating Temperature	41 kPa (6 psi)
At 3000 rpm*	241–517 kPa (35–75 psi)
*If pressure is ZERO at curb idle, DO NOT run engine at 3000 rpm.	

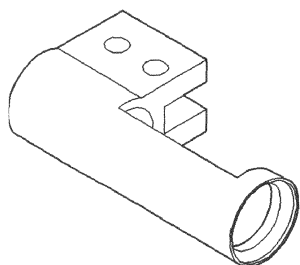
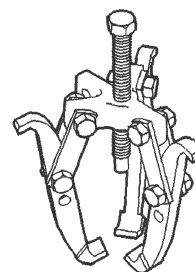
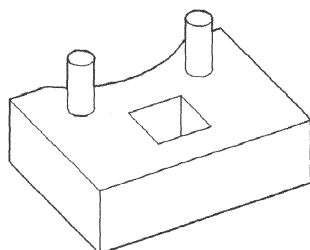
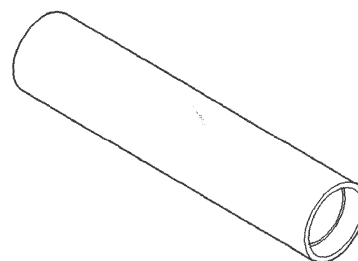
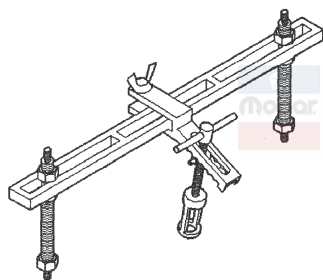
**TORQUE**

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Camshaft Sprocket—Bolt	88	65	—
Camshaft Thrust Case—Bolts	13	—	115
Connecting Rod Cap—Bolts	52	38	—
Crankshaft Main Bearing Cap—Bolts	94	69	—
Crankshaft Damper	182	134	—
Cylinder Head—Bolts	108	80	—
Cylinder Head Cover—Bolts	3.5	—	31
Distributor—Nut	13	—	115
Drive Plate to Crankshaft	95	70	—
Engine Mount Bracket Right—Bolts	61	45	—
Engine Mounting	Refer to Procedure		
Engine Support Bracket—Bolts	45	33	—
Exhaust Manifold to Cylinder Head—Bolts	44	33	—
Exhaust Manifold Heat Shield—Bolts	13	—	115
Heater Pipe Assembly	19	—	168
Intake Manifold Upper—Bolts	18	—	160
Intake Manifold Upper Supports			
—M8 Bolts	18	—	160
—M10 Bolts	36	26.5	—
Intake Manifold Lower—Nuts	21	—	186
Oil Filter Adaptor—Bolts	23	17	—
Oil Filter	14	10	—
Oil Pan—Bolts	6	—	53
Oil Pan Drain—Plug	40	29	—
Oil Pump to Block			
—M8 Bolt	14	—	124
—M10 Bolt	41	30	—
Oil Pump Cover Plate—Bolts	10	—	88.5
Oil Pump Pick-up Tube—Bolt	19	—	168

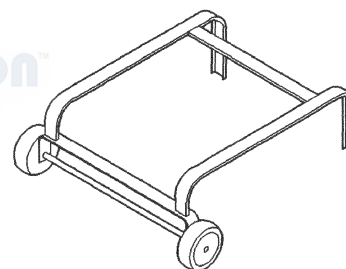
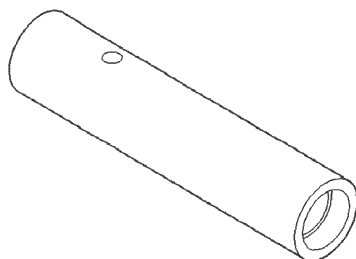
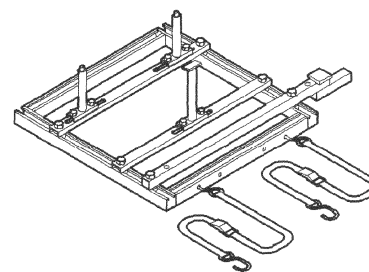
**SPECIFICATIONS (Continued)**

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Oil Dipstick Housing—Bolt	48	35	—
Oil Seal Retainer—Bolts	11	—	104
Rocker Arm Shaft—Bolts	31	23	—
Spark Plug	25	18	—
Timing Belt Cover—Bolts	11	—	104
Timing Belt Auto Tensioner—Bolt	23	17	—
Timing Belt Tensioner Arm Assembly—Bolt	44	33	—
Thermostat Housing— Bolts	19	—	168
Water Inlet Pipe—Bolt	14	—	124
Water Pump—Bolts	24	17	—

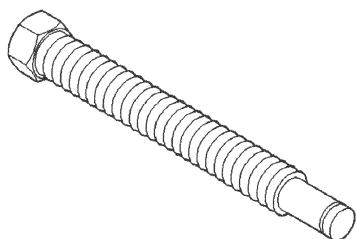
**SPECIAL TOOLS****2.5L ENGINE****Remover C-4679-A****Insert C-4685-C2****Installer MD-998717****Holders MD-998443****Installer MD-998713****Installer MD-998718****Compressor C-3422-B**

**SPECIAL TOOLS (Continued)****Adapter 6526****Puller 1026****Wrench MD-998767****Installer 6052****Compressor MD-998772-A**

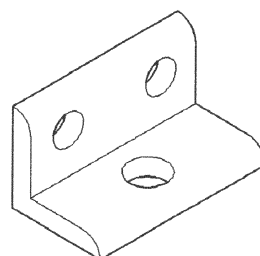
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**Dolly 6135****Installer MD-998774****Fixture Engine 6710**

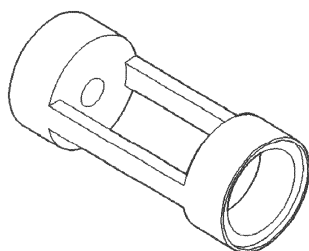
**SPECIAL TOOLS (Continued)**



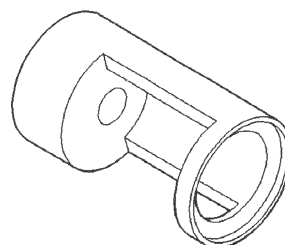
**Screw 6765**



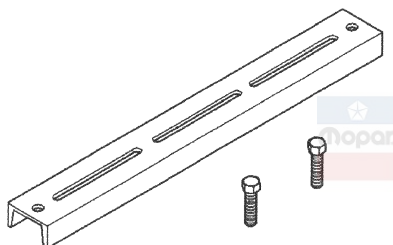
**Bracket Cradle Post Support 6973**



**Adapter 6779**

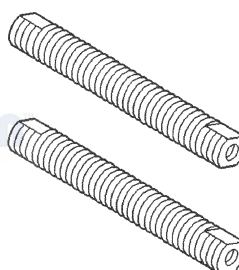


**Adapter 6885**

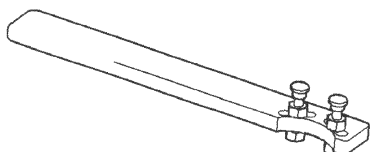


**Support Bar Cradle 6710-3A**

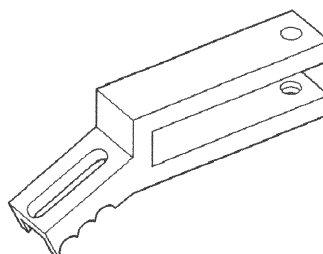
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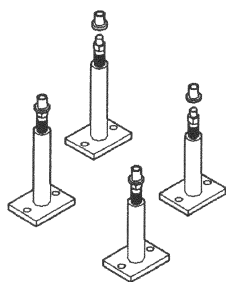
**Posts 6886**



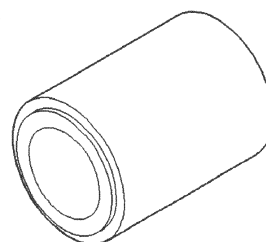
**Holder 6847**



**Adapter 6887**

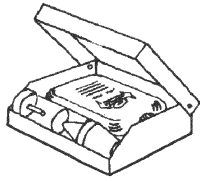


**Engine Cradle Posts 6848**

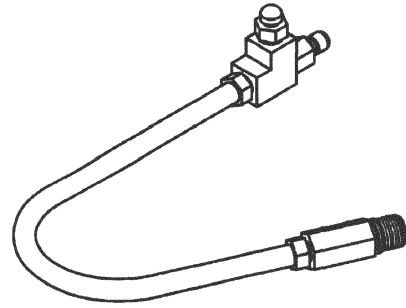


**Camshaft Seal Installer 6863**



**SPECIAL TOOLS (Continued)**

***Combustion Leak Tester C-3685-A***



***Cylinder Compression Pressure Adaptor 8116***



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# EXHAUST SYSTEM

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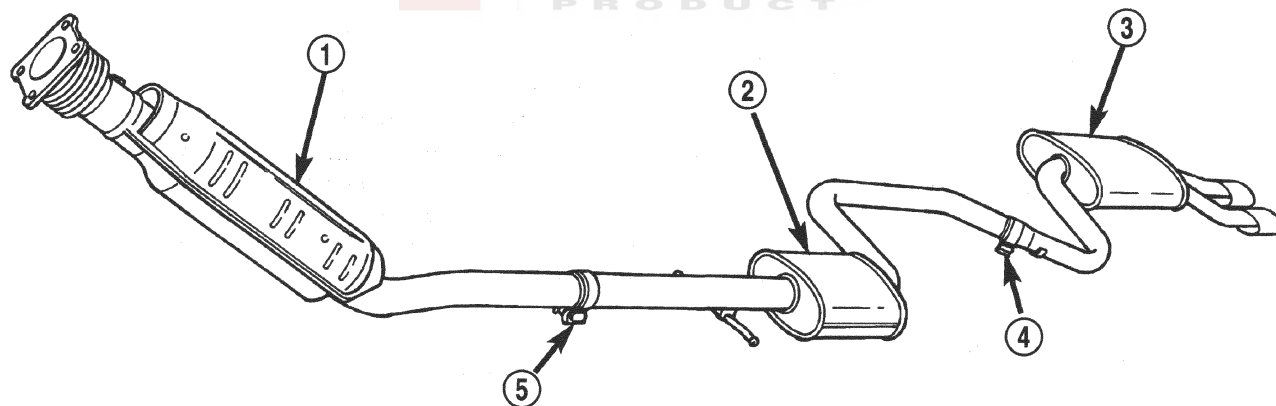
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## DESCRIPTION AND OPERATION

### EXHAUST SYSTEM

#### DESCRIPTION

The exhaust system has a front mounted catalytic converter with flex-joint, center mounted resonator, and rear muffler (Fig. 1). Band clamps are used in two locations to connect system components (Fig. 2).

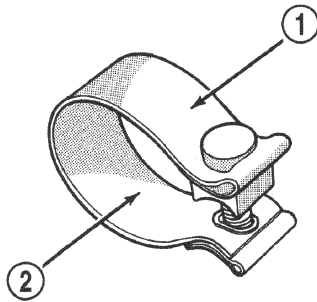


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**Fig. 1 Exhaust System**

- 1 - CATALYTIC CONVERTER
- 2 - RESONATOR
- 3 - MUFFLER

- 4 - CLAMP
- 5 - CLAMP

**DESCRIPTION AND OPERATION (Continued)****CATALYTIC CONVERTER**

9511-5

**Fig. 2 Band Clamp**

- 1 - CLAMP SIZE  
2 - TORQUE SPECIFICATION

**DESCRIPTION**

The under-floor, three-way catalytic converter inlet is connected to the exhaust manifold by use of a flex joint and gasket. The outlet connects to the exhaust system.

**OPERATION**

The three-way catalytic converter simultaneously converts three exhaust emissions into harmless gases. Specifically, HC and CO emissions are converted into water (H<sub>2</sub>O) and carbon dioxide (CO<sub>2</sub>). Oxides of Nitrogen (NO<sub>x</sub>) are converted into elemental Nitrogen (N) and water. The three-way catalyst is most efficient in converting HC, CO and NO<sub>x</sub> at the stoichiometric air fuel ratio of 14.7:1.

The oxygen content in a catalyst is important for efficient conversion of exhaust gases. When a high oxygen content (lean) air/fuel ratio is present for an extended period, oxygen content in a catalyst can reach a maximum. When a rich air/fuel ratio is present for an extended period, the oxygen content in the catalyst can become totally depleted. When this occurs, the catalyst fails to convert the gases. This is known as catalyst "punch through."

Catalyst operation is dependent on its ability to store and release the oxygen needed to complete the

emissions-reducing chemical reactions. As a catalyst deteriorates, its ability to store oxygen is reduced. Since the catalyst's ability to store oxygen is somewhat related to proper operation, oxygen storage can be used as an indicator of catalyst performance. Refer to the appropriate Powertrain Diagnostic Procedure for diagnosis of a catalyst related Diagnostic Trouble Code (DTC).

The combustion reaction caused by the catalyst releases additional heat in the exhaust system, causing temperature increases in the area of the reactor under severe operating conditions. Such conditions can exist when the engine misfires or otherwise does not operate at peak efficiency. **Do not** remove spark plug wires from plugs or by any other means short out cylinders, if exhaust system is equipped with a catalytic converter. Failure of the catalytic converter can occur due to temperature increases caused by unburned fuel passing through the converter. This deterioration of the catalyst core can result in excessively high emission levels, noise complaints, and exhaust restrictions.

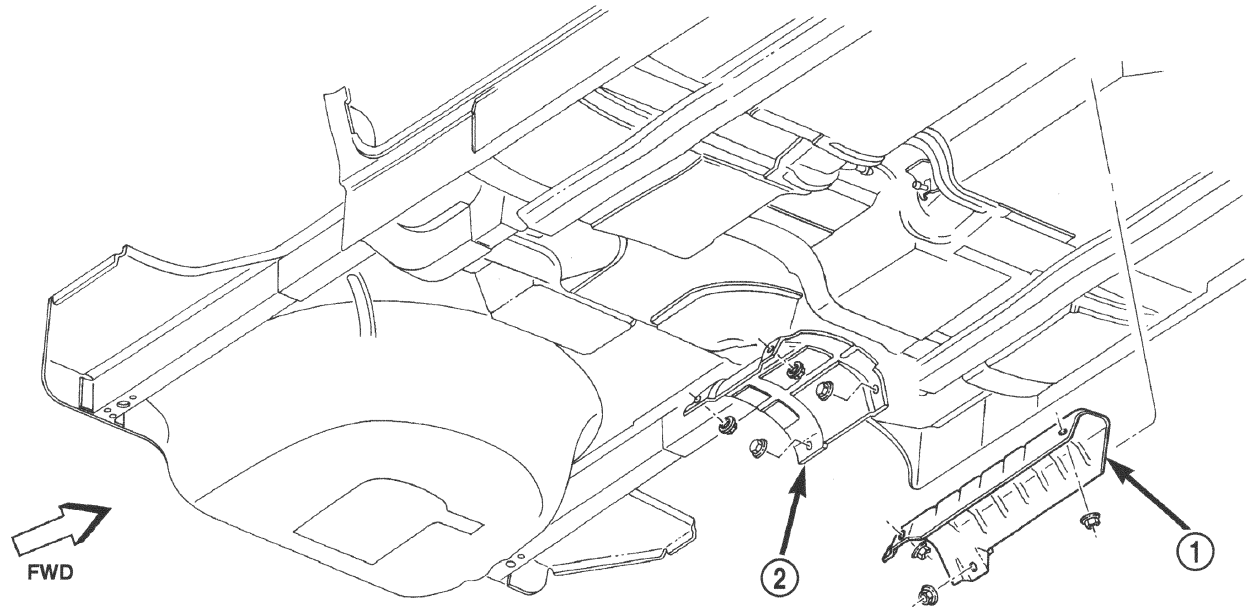
The use of catalysts also involves some non-automotive problems. Unleaded gasoline must be used to avoid poisoning the catalyst core. Do not allow engine to operate above 1200 RPM in neutral for extended periods over 5 minutes. This condition may result in excessive exhaust system/floor pan temperatures because of no air movement under the vehicle.

**CAUTION:** Due to exterior physical similarities of some catalytic converters with pipe assemblies, extreme care should be taken with replacement parts. There are internal converter differences required in some parts of the country (particularly vehicles built for States with strict emission requirements).

**HEAT SHIELDS****DESCRIPTION**

The exhaust system heat shields are attached to the under body of the vehicle (Fig. 3).

## DESCRIPTION AND OPERATION (Continued)



80ae83c0

**Fig. 3 Heat Shields—JX**

1 - HEAT SHIELD

2 - RESONATOR HEAT SHIELD

### OPERATION

Heat shields are needed to protect both the vehicle and the environment from the high temperatures developed near the catalytic converter. All engines are equipped with a heat shield crimped on the top of the converter.

**Avoid application of rust prevention compounds or undercoating materials to exhaust system floor pan heat shields on cars so equipped. Light over spray near the edges is permitted. Application of coating will greatly reduce the efficiency of the heat shields resulting in excessive floor pan temperatures and objectionable fumes.**

### EXHAUST FLEX-JOINT COUPLING

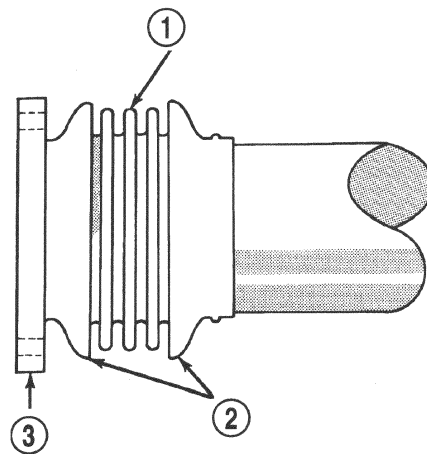
#### DESCRIPTION

The exhaust flex-joint is welded to the catalytic converter (Fig. 4).

#### OPERATION

The exhaust flex-joint coupling is used to secure the catalytic converter to the engine manifold. This joint actually moves back and forth as the engine moves, preventing breakage that could occur from

the back-and-forth motion of a transverse mounted engine.



9511-2

**Fig. 4 Flex-Joint Coupling—2.5L Engine**

- 1 - BELLOWS
- 2 - END CAPS
- 3 - FLANGE



## DIAGNOSIS AND TESTING

### EXHAUST SYSTEM

CONDITION	POSSIBLE CAUSES	CORRECTION
<b>EXCESSIVE EXHAUST NOISE (UNDER HOOD)</b>	<ol style="list-style-type: none"> <li>1. Exhaust manifold cracked or broken.</li> <li>2. Manifold to cylinder head leak.</li> <li>3. EGR Valve to manifold gasket leakage.</li> <li>4. EGR Valve to EGR tube gasket leakage.</li> <li>5. EGR tube to manifold tube leakage.</li> <li>6. Exhaust flex-joint to manifold leak.</li> <li>7. Exhaust flex-joint.</li> <li>8. Pipe and shell noise from front exhaust pipe.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace manifold.</li> <li>2. Tighten manifold and/or replace gasket.</li> <li>3. Tighten fasteners or replace gasket.</li> <li>4. Tighten fasteners or replace gasket.</li> <li>5. Tighten tube nut.</li> <li>6. Tighten joint fasteners and/or replace gasket.</li> <li>7. Replace catalytic converter assembly.</li> <li>8. Characteristic of single wall pipe.</li> </ol>
<b>EXCESSIVE EXHAUST NOISE</b>	<ol style="list-style-type: none"> <li>1. Leak at exhaust pipe joints.</li> <li>2. Burned or rusted out muffler assembly or exhaust pipe.</li> <li>3. Burned or rusted out resonator.</li> <li>4. Restriction in exhaust system.</li> <li>5. Converter material in muffler.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten clamps at leaking joints.</li> <li>2. Replace muffler resonator tailpipe assembly or exhaust pipe with catalytic converter assembly.</li> <li>3. Replace muffler resonator tailpipe assembly.</li> <li>4. Remove restriction if possible, or replace component as necessary.</li> <li>5. Replace muffler and converter assemblies. Check fuel injection and ignition systems for proper operation.</li> </ol>

## REMOVAL AND INSTALLATION

### EXHAUST SYSTEM

#### REMOVAL

**WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.**

(1) Raise vehicle on hoist and apply penetrating oil to clamp nuts of component being removed.

(2) Remove clamp and supports at muffler to resonator assembly (Fig. 5). Remove muffler from resonator pipe.

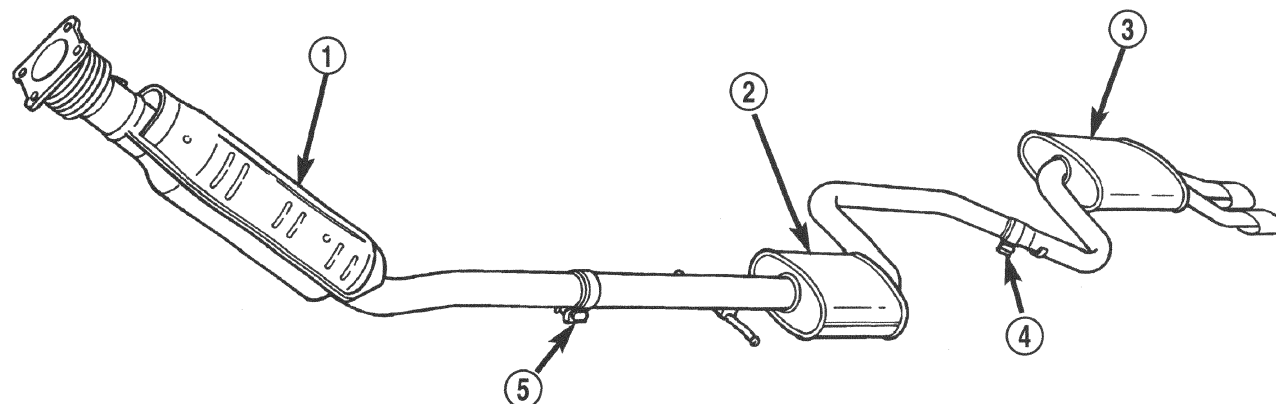
(3) Remove ground strap (Fig. 7).

(4) Remove clamp and supports at the resonator pipe to catalytic converter slip joint (Fig. 5). Separate at slip joint and remove the resonator assembly.

(5) Disconnect downstream and upstream heated oxygen sensors from the catalytic converter pipe (Fig. 6).

(6) Remove catalytic converter to exhaust manifold attaching fasteners (Fig. 6). Remove catalytic converter from vehicle.

## REMOVAL AND INSTALLATION (Continued)

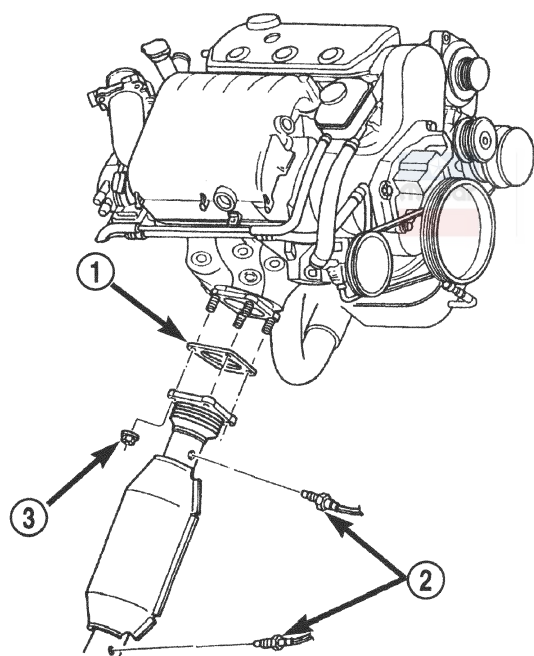


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Fig. 5 Exhaust System Components

- 1 - CATALYTIC CONVERTER  
2 - RESONATOR  
3 - MUFFLER

- 4 - CLAMP  
5 - CLAMP



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Fig. 6 Flex-Joint Connection

- 1 - GASKET  
2 - OXYGEN SENSORS  
3 - NUT

(7) Clean ends of pipes and/or muffler to assure mating of all parts. Discard broken or worn insulators, rusted clamps, supports and attaching parts.

**NOTE:** Band clamps are spot welded to exhaust system. If a band clamp must be replaced, the spot weld must be ground off the exhaust pipe.

**NOTE:** When replacement is required on any component of the exhaust system, it is most important that original equipment parts (or their equivalent) be used to:

- insure proper alignment with other parts in the system.
- provide acceptable exhaust noise levels and does not change exhaust system back pressure that could affect emissions and performance.

## INSTALLATION

When assembling exhaust system **do not** tighten clamps until components are aligned and supports have equal load on them (Fig. 7).

(1) Assemble catalytic converter to exhaust manifold connection (Fig. 6).

(2) Assemble resonator pipe to catalytic converter and attach to the supports on the underbody (Fig. 7).

(3) Install the muffler to resonator pipe and attach to the supports on the underbody (Fig. 7).

**NOTE:** Always work from the front to rear of exhaust system when aligning and tightening exhaust system components.

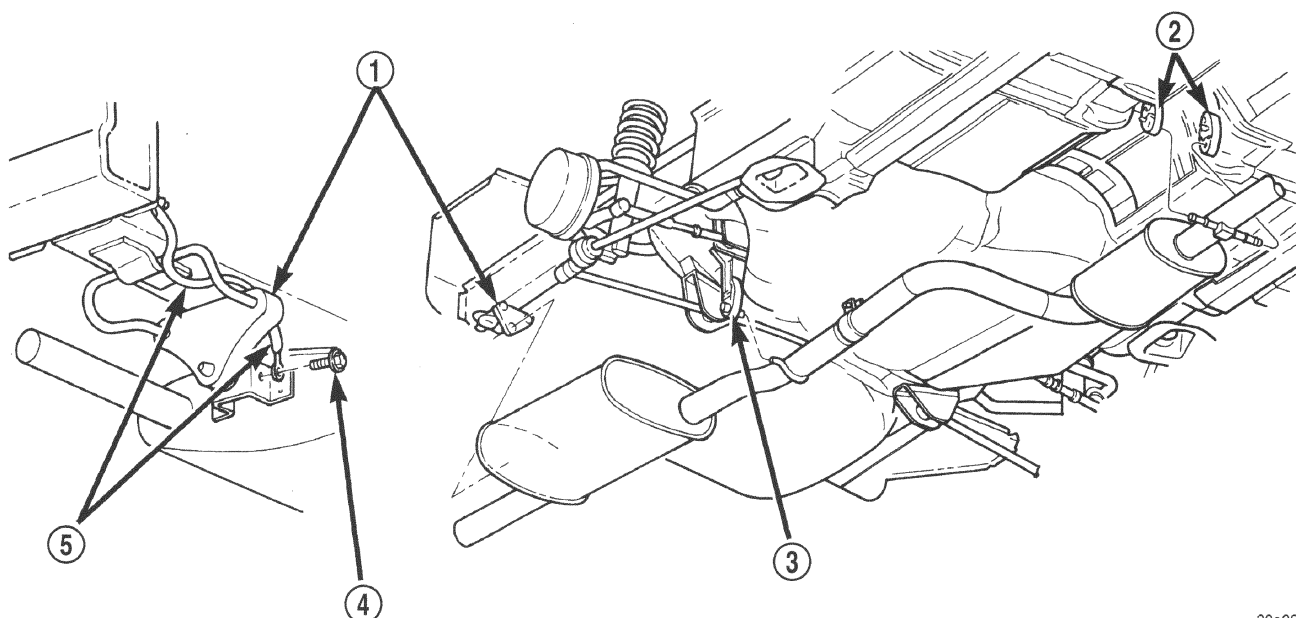
(4) Align and tighten the catalytic converter to exhaust manifold fasteners (Fig. 6). Tighten fasteners to 28 N·m (250 in. lbs.).

(5) Align each component to maintain position and proper clearance with underbody parts and that all supports have equal load on them. Tighten clamps to 75 N·m (55 ft. lbs.) (Fig. 8).

(6) Connect ground strap.

(7) Connect the downstream heated oxygen sensor.

(8) Connect the upstream heated oxygen sensor.

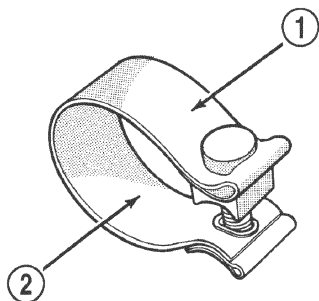
**CLEANING AND INSPECTION (Continued)**

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**Fig. 7 Exhaust System Support Insulators**

- 1 - REAR MUFFLER SUPPORT ISOLATORS
- 2 - RESONATOR SUPPORT ISOLATORS
- 3 - MUFFLER/FRONT PIPE SUPPORT ISOLATOR

- 4 - FASTENER
- 5 - GROUND STRAP



9511-5

**Fig. 8 Band Clamp**

- 1 - CLAMP SIZE
- 2 - TORQUE SPECIFICATION

**NOTE:** Slip joint band clamps are spot welded to exhaust system. If a band clamp must be replaced, the spot weld must be ground off.

**ADJUSTMENTS****EXHAUST SYSTEM ALIGNMENT**

A misaligned exhaust system is usually indicated by a vibration, rattling noise, or binding of exhaust system components. These noises are sometimes hard to distinguish from other chassis noises. Inspect exhaust system for broken or loose clamps, heat shields, isolators, and brackets. Replace or tighten as necessary. It is important that exhaust system clearances and alignment be maintained.

Perform the following procedures to align the exhaust system:

- (1) Loosen clamps and support brackets.
- (2) Align the exhaust system starting at the front, working rearward.
- (3) Tighten all clamps and brackets once alignment and clearances are achieved.

**CLEANING AND INSPECTION****EXHAUST SYSTEM****INSPECTION**

Inspect the exhaust pipes, catalytic converters, muffler, and resonators for cracked joints, broken welds and corrosion damage that would result in a leaking exhaust system. Inspect the clamps, support brackets, and insulators for cracks and corrosion damage.

## **SPECIFICATIONS**

### **TORQUE**

<b>DESCRIPTION</b>	<b>N·m</b>	<b>Ft. Lbs.</b>	<b>In. Lbs.</b>
Band Clamps—Fastener	75	55	—
Catalytic Converter to Exhaust Manifold Flange—Fasteners	32	24	—
Cross Under Pipe—Fasteners	31	—	250
Heat Shields to Body— Fasteners	5	—	40



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FRAME AND BUMPERS

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BUMPERS

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HEADLAMP ADAPTER ASSEMBLY .....	2		

REMOVAL AND INSTALLATION

FRONT BUMPER FASCIA

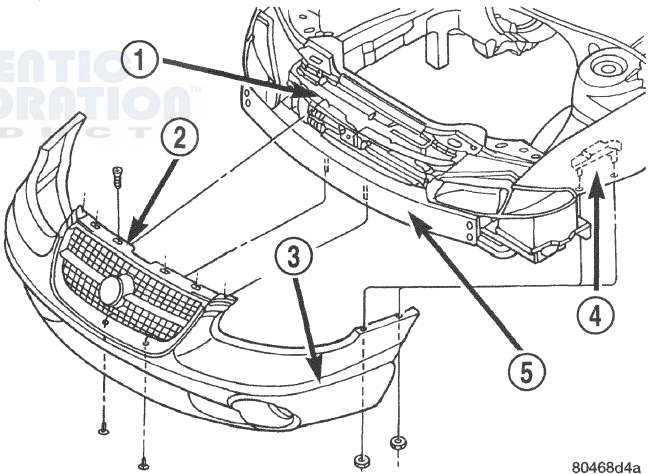
It is not necessary to remove the headlamp assemblies to remove the front bumper fascia.

REMOVAL

- (1) Release hood latch and open hood.
- (2) Remove screws holding top of grille to headlamp adapter assembly (Fig. 1).
- (3) Hoist and support vehicle on safety stands. Refer to Group 0, Lubrication and Maintenance, for proper hoisting and jacking procedures.
- (4) Remove push-in fasteners holding fascia to underside of bumper reinforcement.
- (5) Remove inner wheelhouse as necessary to access nuts holding fascia wings to fender.
- (6) Remove nuts holding fascia wings to fender.
- (7) Slide fascia forward and separate fascia from vehicle.
- (8) Disengage fog lamp wire connectors from back of fog lamps, if so equipped.

INSTALLATION

- (1) Ensure that energy management foam is properly installed in front fascia (Fig. 2).
- (2) Engage fog lamp wire connectors to back of fog lamps, if so equipped.
- (3) Position fascia on vehicle and slide rearward, being careful to ensure that the grille slides between hood latch handle and headlamp adapter assembly.

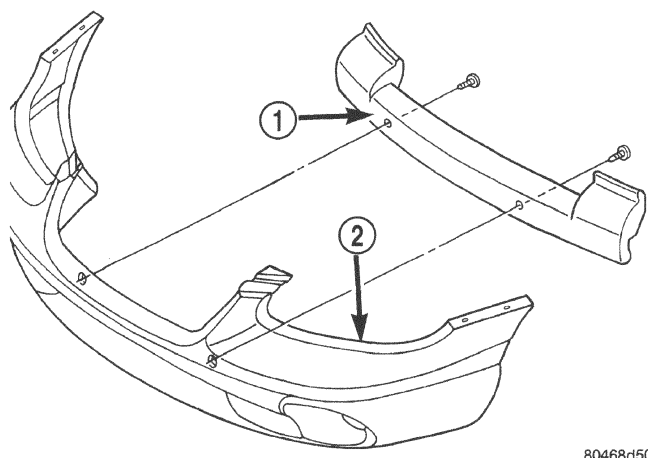


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Fig. 1 Front Bumper Fascia

- 1 - HEADLAMP ADAPTER ASSEMBLY
- 2 - GRILLE
- 3 - FASCIA
- 4 - FENDER
- 5 - FRONT BUMPER REINFORCEMENT

- (4) Install nuts holding fascia wings to fender.
- (5) Install inner wheelhouse.
- (6) Install push-in fasteners holding fascia to underside of bumper reinforcement.
- (7) Install screws holding top of grille to headlamp adapter assembly.

**REMOVAL AND INSTALLATION (Continued)**

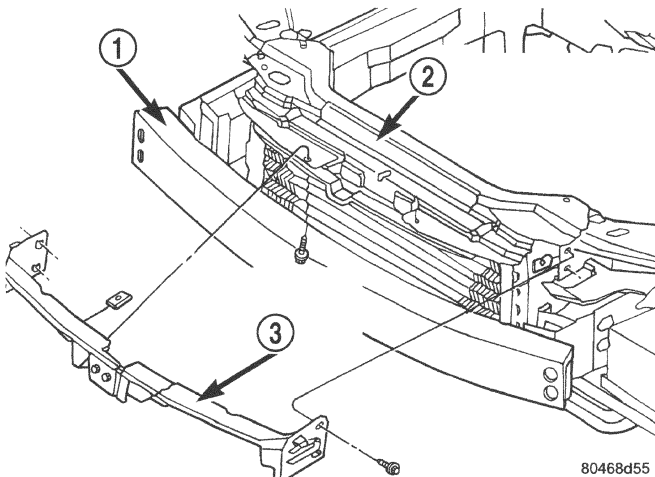
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**Fig. 2 Front Bumper Energy Management Foam**

- 1 - FRONT BUMPER ENERGY MANAGEMENT FOAM  
2 - FRONT FASCIA

**HEADLAMP ADAPTER ASSEMBLY****REMOVAL**

- (1) Remove headlamp assemblies. Refer to Group 8L, Lamps, for proper procedure.
- (2) Remove front fascia.
- (3) Remove bolts holding headlamp adapter to radiator closure panel from headlamp cavities (Fig. 3).
- (4) Remove bolts holding underside of adapter assembly to upper radiator crossmember.
- (5) Separate headlamp adapter assembly from vehicle.



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**Fig. 3 Headlamp Adapter Assembly**

- 1 - FRONT BUMPER REINFORCEMENT  
2 - UPPER RADIATOR SUPPORT CROSSMEMBER  
3 - HEADLAMP ADAPTER ASSEMBLY

**INSTALLATION**

- (1) Position headlamp adapter assembly on vehicle.
- (2) Loosely install bolts holding headlamp adapter to radiator closure panel from headlamp cavities.
- (3) Loosely install bolts holding underside of adapter assembly to upper radiator crossmember.
- (4) Tighten all bolts.
- (5) Install front fascia.
- (6) Install headlamp assemblies. Refer to Group 8L, Lamps, for proper procedures.

**REAR BUMPER FASCIA****REMOVAL**

- (1) Release decklid latch and open decklid.
- (2) Remove trunk lining as necessary to access nut attaching rear fascia to rear closure panel.
- (3) Remove screws attaching fascia to rear closure panel and nuts securing to inner quarter panel (Fig. 4).
- (4) Hoist and support vehicle on safety stands. Refer to Group 0, Lubrication and Maintenance, for proper procedure.
- (5) Remove push-in fasteners attaching bottom of fascia to rear bumper reinforcement.
- (6) Disengage license plate lamp wire connector.
- (7) Remove rear wheelhouse splash shields as necessary to access nuts attaching fascia to quarter panels.
- (8) Remove nuts attaching rear fascia to quarter panels.
- (9) Remove screw attaching fascia to right rear quarter panel.
- (10) Slide fascia rearward and remove from vehicle.

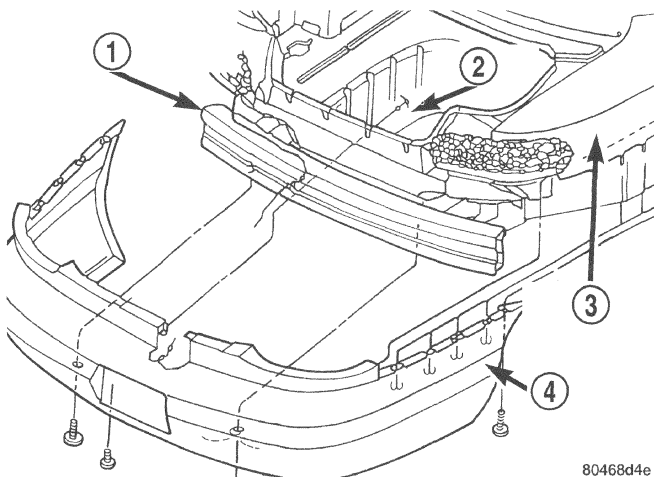
**INSTALLATION**

- (1) Ensure that the energy management foam is properly installed in rear fascia (Fig. 5).
- (2) Position fascia on vehicle and slide forward to engage studs on quarter panel.

**CAUTION:** Ensure that license plate wire connector is properly routed through energy management foam and fascia.

- (3) Install nuts attaching rear fascia to quarter panels, starting with the rearward nut working forward.
- (4) Install screw attaching rear fascia to right rear quarter panel.

**NOTE:** Hold fascia completely forward until first nut is secured.

**REMOVAL AND INSTALLATION (Continued)****Fig. 4 Rear Bumper Fascia**

- 1 - REAR BUMPER REINFORCEMENT
- 2 - TRUNK
- 3 - QUARTER PANEL
- 4 - REAR BUMPER FASCIA

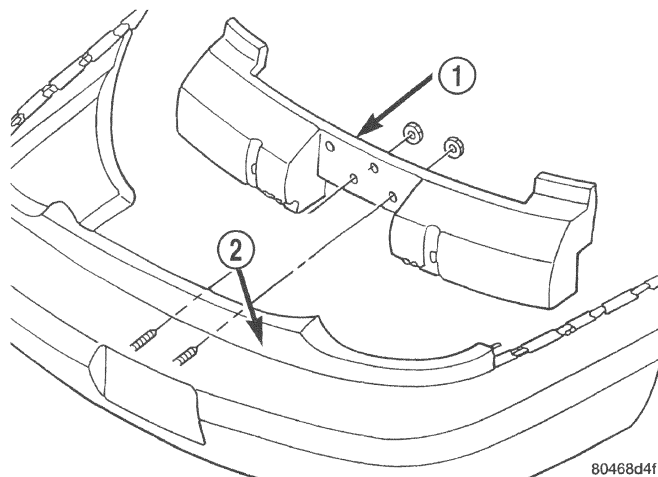
- (5) Install rear wheelhouse splash shields.
- (6) Connect license plate lamp wire connector.
- (7) Install push-in fasteners attaching rear fascia to rear bumper reinforcement.
- (8) Install nuts attaching rear fascia to inner quarter panel.
- (9) Install screws attaching rear fascia to closure panel.
- (10) Install trunk lining.

**REAR BUMPER REINFORCEMENT****REMOVAL**

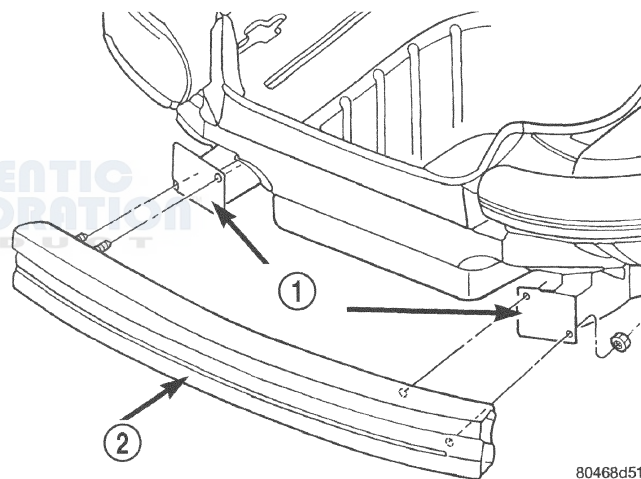
- (1) Remove rear fascia.
- (2) Support bumper reinforcement on a suitable lifting device.
- (3) Mark position of nuts on frame rail to aid in installation.
- (4) Remove nuts holding rear bumper reinforcement to frame rail (Fig. 6).
- (5) Separate bumper reinforcement from vehicle.

**INSTALLATION**

- (1) Position rear bumper reinforcement on vehicle.

**Fig. 5 Rear Bumper Energy Management Foam**

- 1 - ENERGY MANAGEMENT FOAM
- 2 - REAR BUMPER FASCIA

**Fig. 6 Rear Bumper Reinforcement**

- 1 - FRAME RAIL
- 2 - FRONT BUMPER REINFORCEMENT

- (2) Install nuts holding bumper reinforcement to frame rail. Use previously made marks to properly position bumper reinforcement.
- (3) Install rear fascia.



## FRAME

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## DESCRIPTION AND OPERATION

### REAR SUSPENSION CROSSMEMBER

#### DESCRIPTION

This vehicle is equipped with a bolt in type rear suspension crossmember. The crossmember on this vehicle is the same for all of the optional suspensions that are available on the vehicle.

### REMOVAL AND INSTALLATION

#### FRONT SUSPENSION CROSSMEMBER

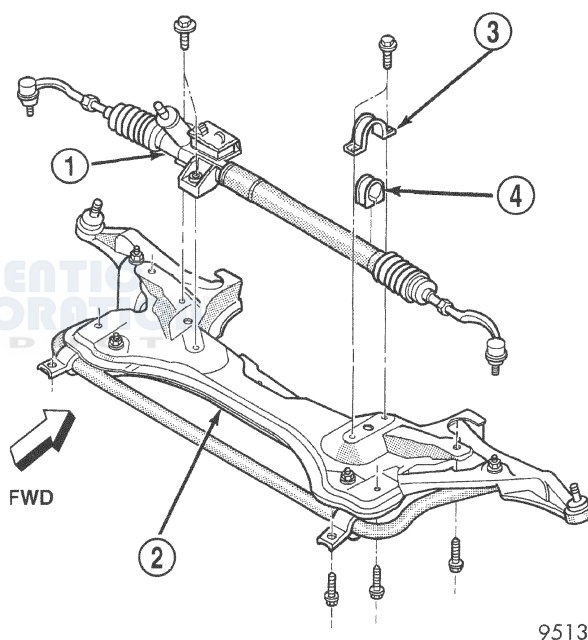
##### REMOVAL

- (1) Hoist and support vehicle on safety stands. Refer to Group 0, Lubrication and Maintenance, for proper procedure.
- (2) Place a suitable lifting device under front suspension crossmember.
- (3) Remove bolts holding suspension strut to the lower control arm. Refer to Group 2, Suspension, for proper procedures.
- (4) Disengage lower ball joints from lower control arms. Refer to Group 2, Suspension, for proper procedures.
- (5) Remove bolts holding front of suspension crossmember to frame rails under upper control arms.
- (6) Loosen bolts holding rear of suspension crossmember to frame rail torque boxes.
- (7) Allow the front of the suspension crossmember to swing away from the frame rails.
- (8) Remove bolts holding steering gear to top of suspension crossmember (Fig. 1).

**CAUTION:** Do not allow steering gear to hang by the pressure or return hoses, damage to hoses can result.

- (9) Using mechanics wire, tie steering gear to structure above.
- (10) Raise crossmember back into position.

- (11) Remove bolts holding rear of crossmember to frame rail torque boxes.
- (12) Lower front suspension crossmember away from bottom of vehicle.



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**Fig. 1 Front Suspension Crossmember**

- 1 - STEERING GEAR
- 2 - FRONT SUSPENSION CROSSMEMBER
- 3 - CLAMP
- 4 - ISOLATOR

#### INSTALLATION

- (1) Raise front suspension crossmember into position on vehicle.
- (2) Loosely install bolts holding rear of crossmember to frame rail torque boxes.
- (3) Lower crossmember and install bolts holding steering gear to top of suspension crossmember.
- (4) Raise crossmember into position.
- (5) Tighten bolts holding rear of suspension crossmember to frame rail torque boxes.
- (6) Install bolts holding front of suspension crossmember to frame rails under upper control arm.



## REMOVAL AND INSTALLATION (Continued)

(7) Engage lower ball joint to lower control arms. Refer to Group 2, Suspension, for proper procedures.

(8) Install bolts holding suspension strut to lower control arm. Refer to Group 2, Suspension, for proper procedures.

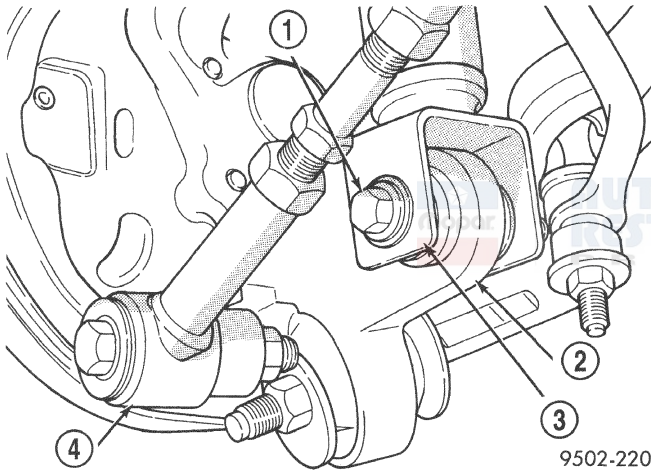
## REAR SUSPENSION CROSSMEMBER

### REMOVE

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove both rear wheel and tire assemblies from the vehicle.

(3) Remove the shock absorber clevis bracket to rear knuckle attaching bolt and nut on both sides of the vehicle (Fig. 2).



**Fig. 2 Shock Absorber To Knuckle Attaching**

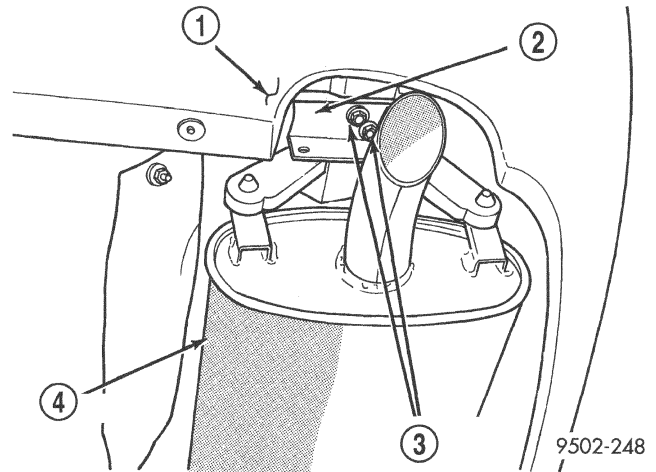
- 1 - ATTACHING BOLT
- 2 - REAR KNUCKLE
- 3 - SHOCK ABSORBER CLEVIS BRACKET
- 4 - LATERAL LINK

(4) Remove muffler support bracket from rear frame rail (Fig. 3).

(5) Remove the rear exhaust pipe hanger from the rear suspension crossmember (Fig. 4). Let the exhaust system drop down as far as possible.

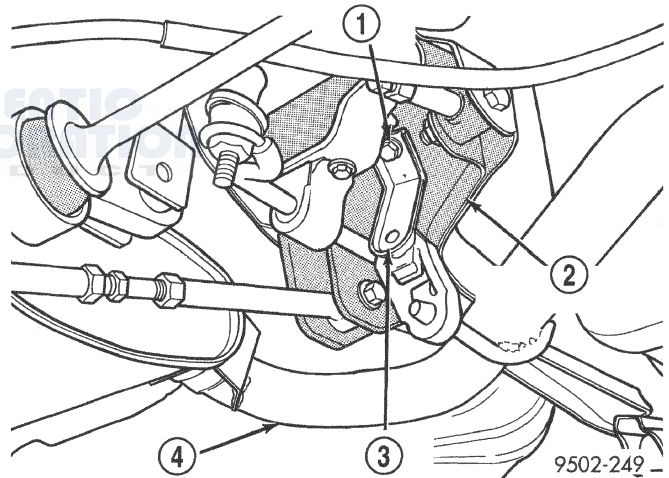
(6) Position a transmission jack and wooden block under the center of the rear suspension crossmember to support and lower crossmember during removal (Fig. 5).

(7) Remove the routing clips for the wheel speed sensor cable from the brackets on the upper control arm (Fig. 6).



**Fig. 3 Muffler Support Bracket**

- 1 - REAR FASCIA
- 2 - MUFFLER SUPPORT BRACKET
- 3 - ATTACHING BOLTS
- 4 - MUFFLER



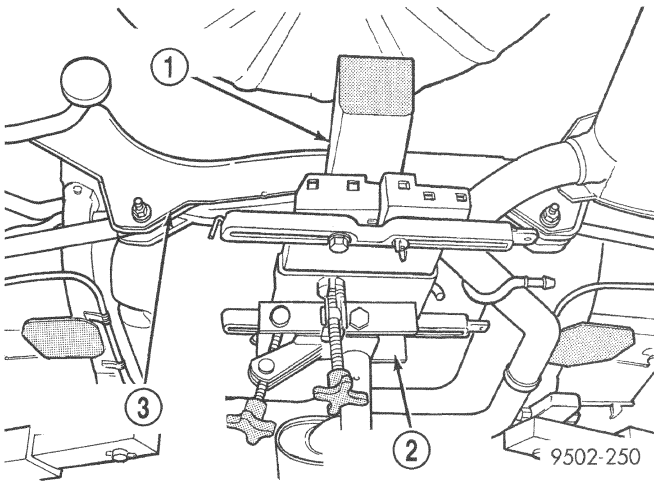
**Fig. 4 Exhaust Pipe Hanger At Rear Suspension Crossmember**

- 1 - BOLT
- 2 - REAR SUSPENSION CROSSMEMBER
- 3 - HANGER BRACKET
- 4 - EXHAUST PIPE

(8) Remove the nuts and bolts on each side of the vehicle attaching the 4 lateral links to the knuckles.

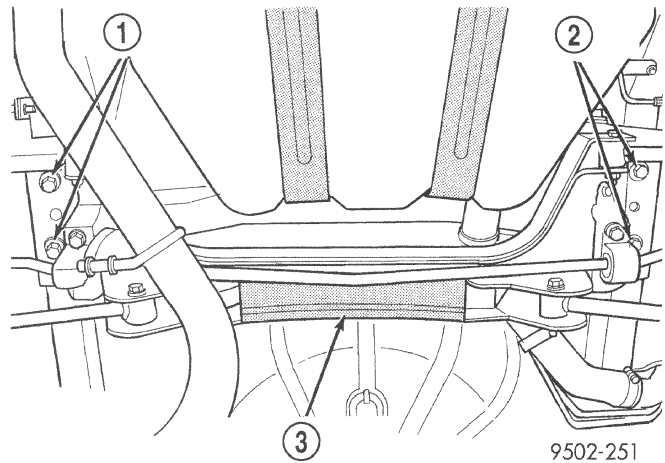
(9) Remove the 4 bolts attaching the rear suspension crossmember to the rear frame rails (Fig. 7).

(10) Lower the rear suspension crossmember enough to access the upper control arm pivot bar to crossmember attaching bolts (Fig. 8).

**REMOVAL AND INSTALLATION (Continued)**

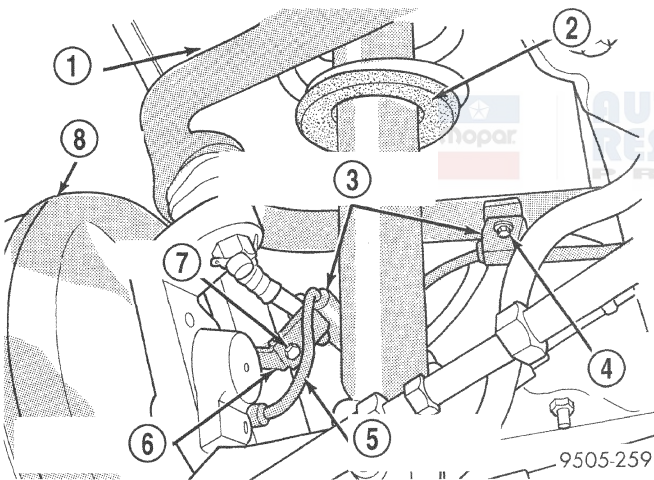
**Fig. 5 Lowering And Supporting Rear Suspension Crossmember**

- 1 - WOODEN BLOCK
- 2 - TRANSMISSION JACK
- 3 - REAR SUSPENSION CROSSMEMBER



**Fig. 7 Suspension Crossmember Attachment To Frame Rails**

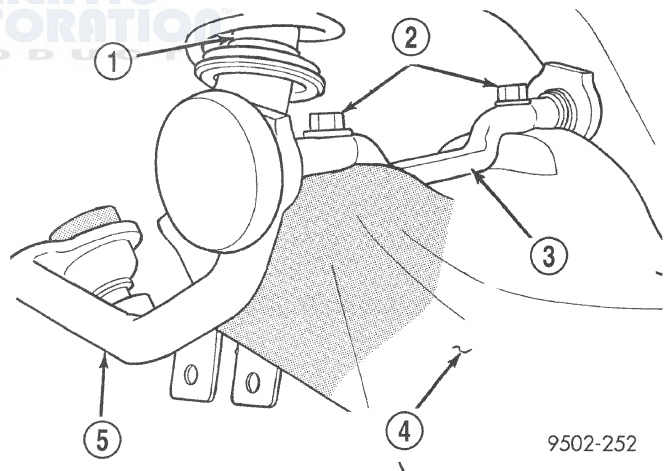
- 1 - ATTACHING BOLTS
- 2 - ATTACHING BOLTS
- 3 - REAR SUSPENSION CROSSMEMBER



**Fig. 6 Speed Sensor Cable Attachment To Control Arm**

- 1 - UPPER CONTROL ARM
- 2 - SHOCK ABSORBER
- 3 - SPEED SENSOR CABLE ROUTING CLIPS
- 4 - BOLT
- 5 - SPEED SENSOR CABLE
- 6 - BRAKE FLEX HOSE BRACKET
- 7 - BOLT
- 8 - BRAKE DRUM

**NOTE:** One flat washer is used at each upper control arm pivot bar attaching bolt. The flat washer is located between the pivot bar and the rear suspension crossmember. Be sure the washers are not lost when removing the pivot bar attaching bolts from the rear suspension crossmember.



**Fig. 8 Upper Control Arm Attachment To Crossmember**

- 1 - SHOCK ABSORBER
- 2 - ATTACHING BOLTS
- 3 - UPPER CONTROL ARM PIVOT BAR
- 4 - REAR SUSPENSION CROSSMEMBER
- 5 - UPPER CONTROL ARM

(12) Lower the rear suspension crossmember, lateral arms and stabilizer bar as far as possible using the transmission jack. Then with the aid of a helper remove rear suspension crossmember from the vehicle.

(13) Transfer the lateral arms, stabilizer bar mounting brackets and the stabilizer bar and bush-



## REMOVAL AND INSTALLATION (Continued)

ings to the replacement crossmember before installing the replacement crossmember in the vehicle. Tighten the stabilizer bar mounting bracket to rear crossmember mounting bolts to a torque of 27 N·m (20 ft. lbs.). Tighten the 4 lateral arm to crossmember attaching bolts to a torque of 95 N·m (80 ft. lbs.). **Install the lateral arm to crossmember bolts so head of bolt will be toward the front of the vehicle when the crossmember is installed.**

## INSTALLATION

(1) Install the rear suspension crossmember, lateral arms and rear stabilizer bar back into the vehicle as an assembly.

(2) With the aid of a helper position rear suspension crossmember back into vehicle and support it using the transmission jack.

**NOTE: One flat washer is used at each upper control arm pivot bar attaching bolt. The flat washer is located between the pivot bar and the rear suspension crossmember. Be sure 1 flat washer is used at each bolt attaching the pivot bar to the rear suspension crossmember.**

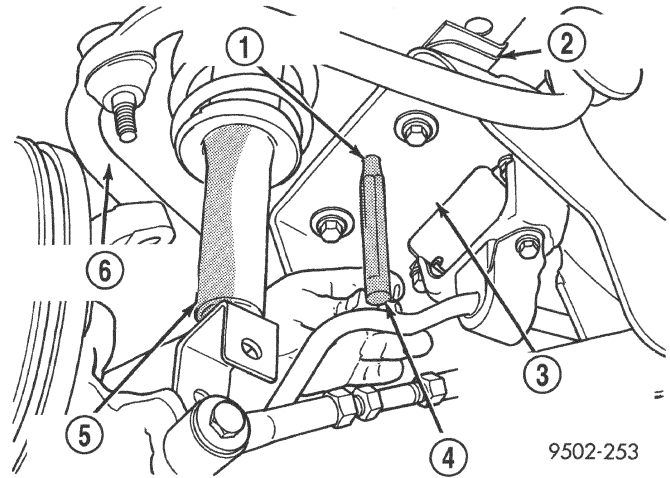
(3) Align the upper control arm pivot bars with the mounting holes in the rear suspension crossmember. Install the pivot bar attaching bolts and washers. Tighten the 4 pivot bar to crossmember attaching bolts (Fig. 8) to a torque of 107 N·m (80 ft. lbs.).

(4) Using transmission jack, raise rear suspension crossmember up to the rear frame rails and loosely install the 4 attaching bolts.

(5) Position a drift of the appropriate size into the positioning hole in each side of rear suspension crossmember and locating holes in the frame rail of the body. (Fig. 9). This is required to properly position the rear suspension crossmember side-to-side and front-to-rear on the body of the vehicle. Then tighten the 4 crossmember to frame rail attaching bolts to 107 N·m (80 ft. lbs.). Remove drifts from rear suspension crossmember.

(6) Align lateral links with knuckles and install the lateral arm to knuckle attaching bolts and washers. Tighten the 4 lateral arm to knuckle attaching bolts to a torque of 107 N·m (80 ft. lbs.).

(7) Remove transmission jack supporting rear suspension crossmember.



**Fig. 9 Locating Rear Suspension Crossmember In Vehicle**

- 1 - POSITIONING HOLE
- 2 - FRAME RAIL
- 3 - REAR SUSPENSION CROSSMEMBER
- 4 - DRIFT
- 5 - SHOCK ABSORBER
- 6 - UPPER CONTROL ARM

(8) Install muffler support bracket on rear frame rail (Fig. 3). Install rear exhaust pipe hanger on rear suspension crossmember (Fig. 4).

(9) Install the wheel speed sensor cable routing clip on the upper control arm mounting bracket (Fig. 6). Install and securely tighten attaching bolt.

(10) Install wheel and tire assembly on vehicle. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(11) Lower vehicle to the ground.

(12) Check and reset if required, rear wheel alignment (camber and toe) to meet the preferred specifications.

## SPECIFICATIONS

### FRAME DIMENSIONS

Frame dimensions are listed in metric scale. All dimensions are from center to center of Principal Locating Point (PLP), or from center to center of PLP and fastener location.

**SPECIFICATIONS (Continued)****VEHICLE PREPARATION**

Position the vehicle on a level work surface. Using screw or bottle jacks, adjust the vehicle PLP heights to the specified dimension above a level work surface. Vertical dimensions can be taken from the work surface to the locations indicated were applicable (Fig. 10), (Fig. 11), (Fig. 12), (Fig. 13), and (Fig. 14).

**TORQUE SPECIFICATIONS****DESCRIPTION****TORQUE****Rear Bumper Reinforcement**

Attaching Nut . . . . . 28 N·m (21 ft. lbs.)

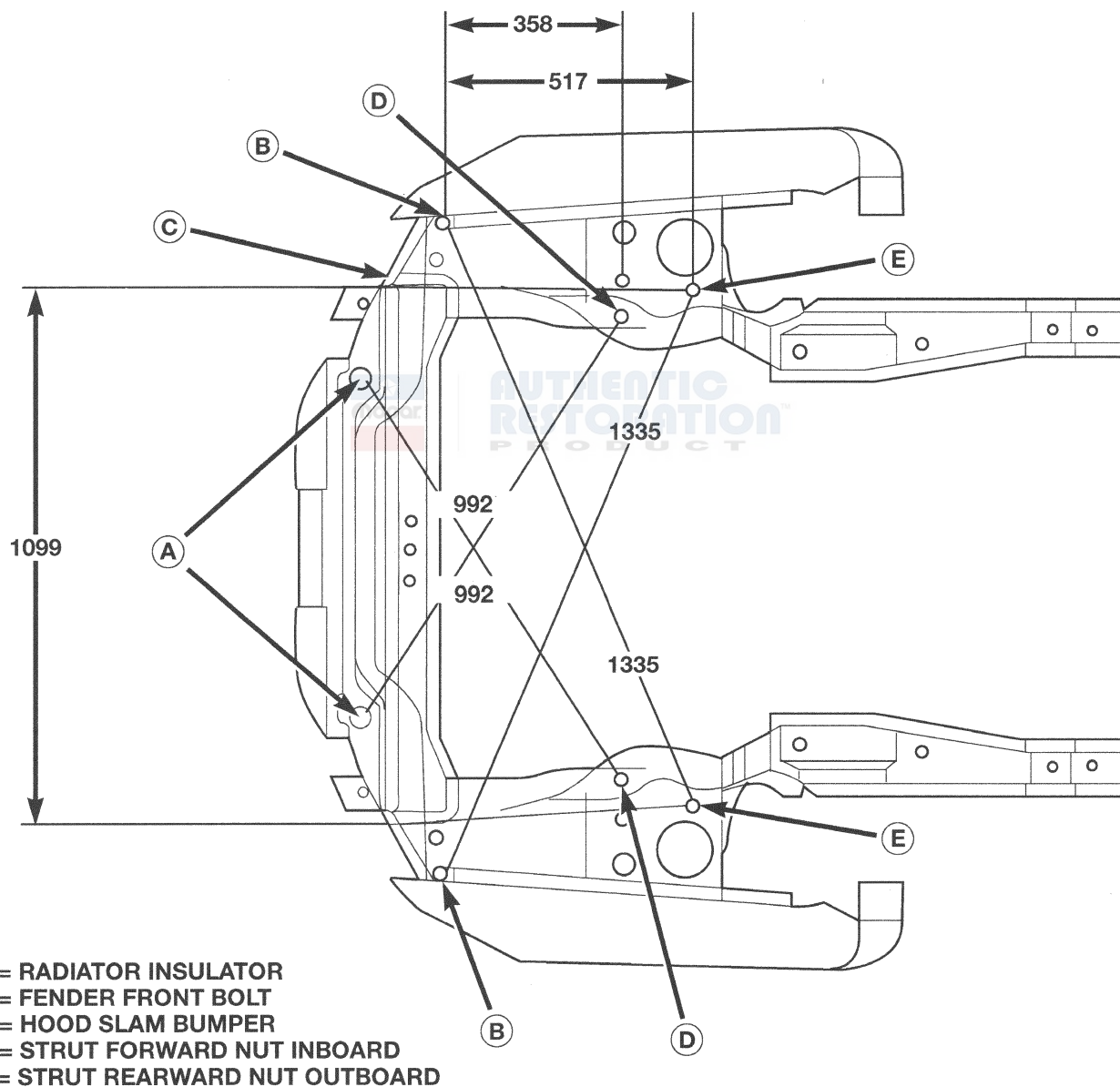
**Front Suspension Crossmember**

Attaching Bolt Front . . . . . 109 N·m (80 ft. lbs.)

Attaching Bolt Rear . . . . . 102 N·m (75 ft. lbs.)

**Radiator Support Crossmember**

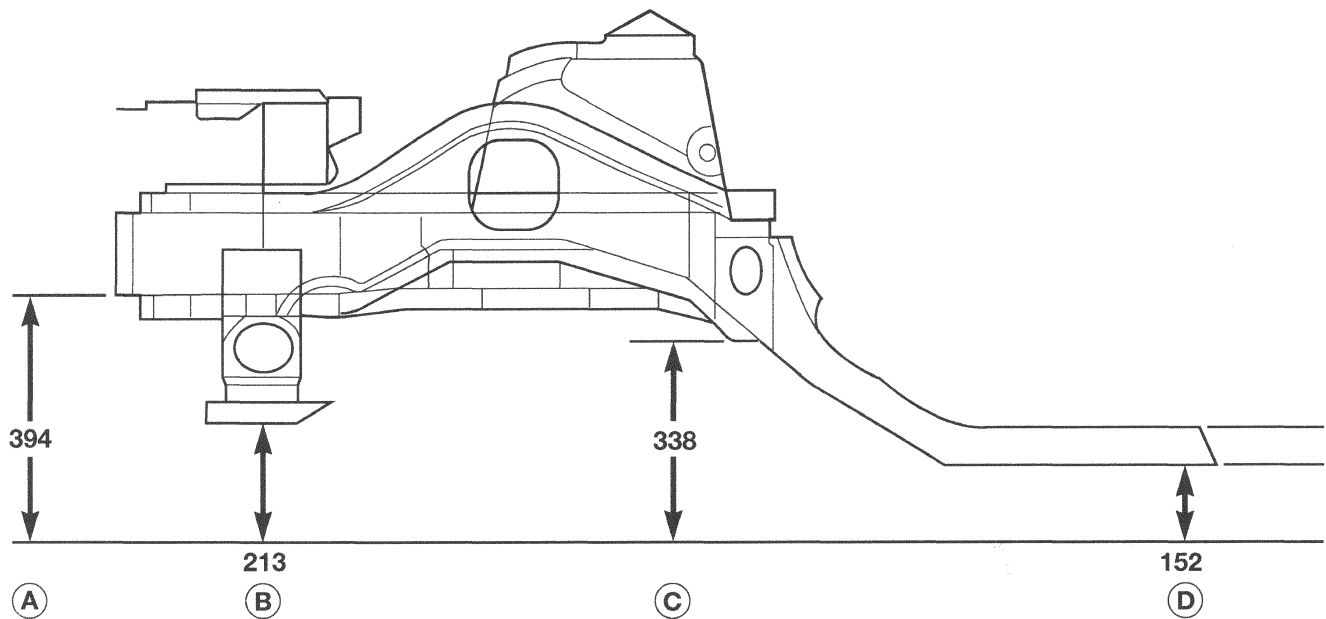
Attaching Bolts . . . . . 115 N·m (85 ft. lbs.)



*Fig. 10 Engine Compartment Top View*



**SPECIFICATIONS (Continued)**



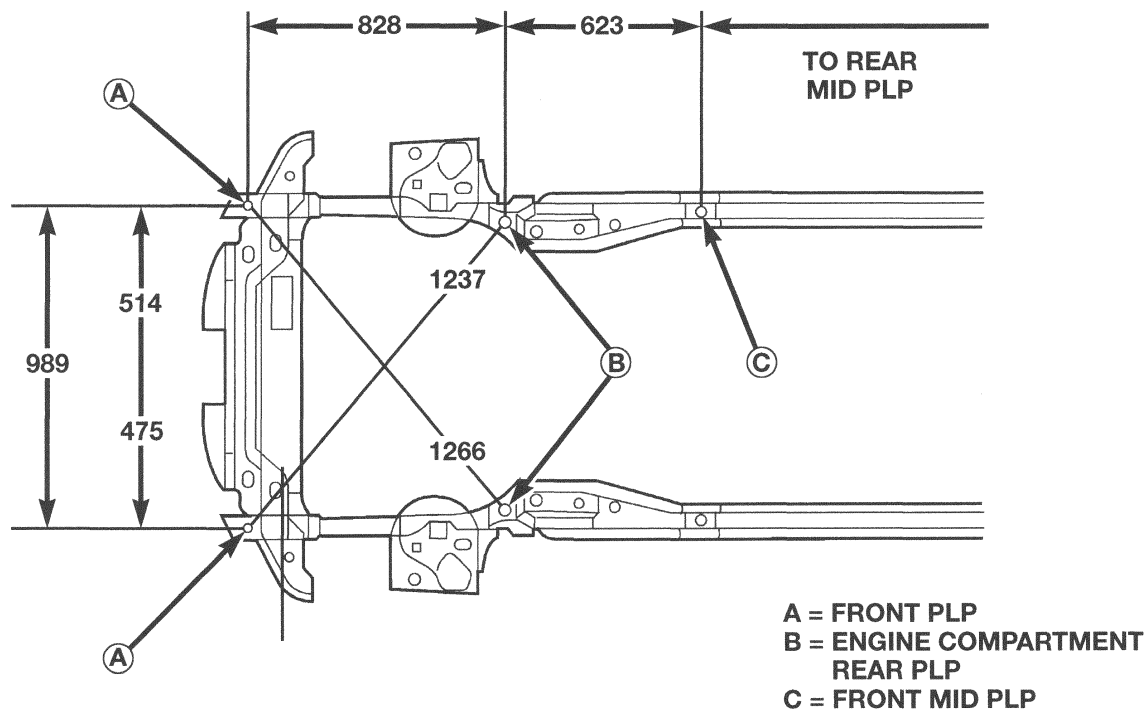
A = BOTTOM OF EXTENSION  
 B = BOTTOM OF RADIATOR CLOSURE  
 C = ENGINE COMPARTMENT REAR PLP  
 D = PLP



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 RESTORATION<sup>™</sup>  
 PRODUCT**

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**Fig. 11 Engine Compartment Side View**

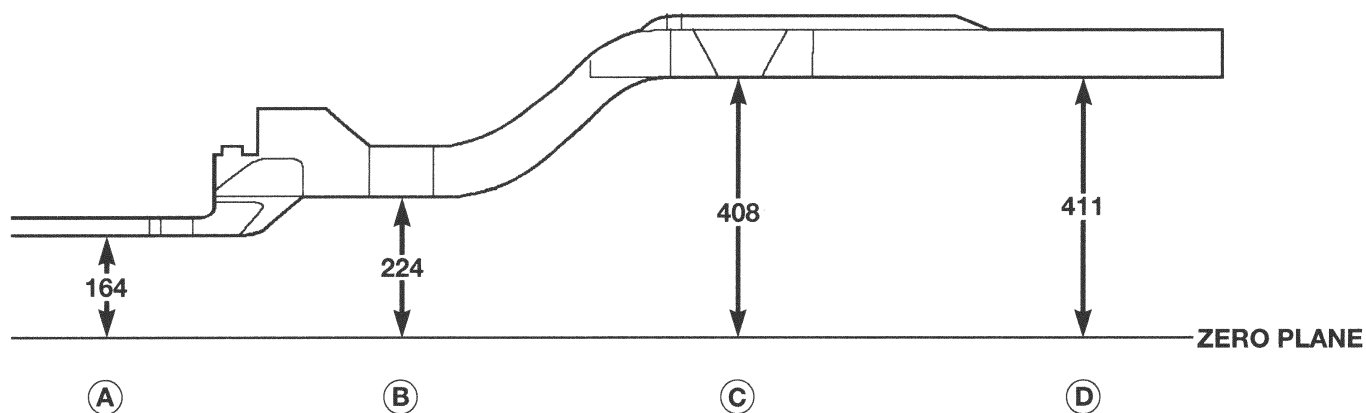


A = FRONT PLP  
 B = ENGINE COMPARTMENT  
 REAR PLP  
 C = FRONT MID PLP

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**Fig. 12 Forward Frame Section Bottom View**

## SPECIFICATIONS (Continued)



A = REAR MID PLP

B = CENTER OF TRACK BAR MOUNT

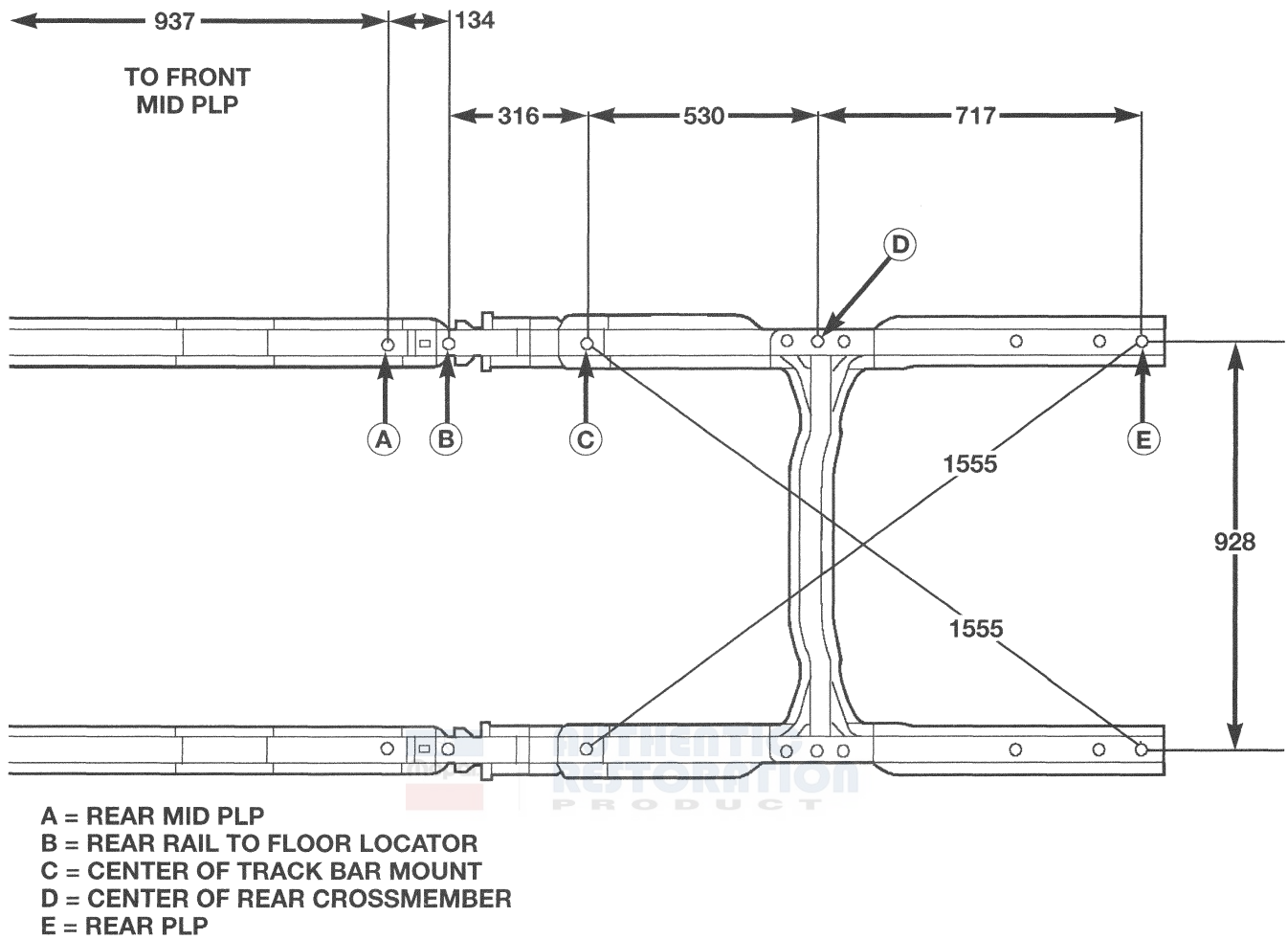
C = CENTER OF REAR CROSSMEMBER

D = REAR PLP

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*Fig. 13 Rear Frame Section Side View*

**SPECIFICATIONS (Continued)**



*Fig. 14 Rear Frame Section Bottom View*

## FUEL SYSTEM

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## FUEL DELIVERY SYSTEM

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### DESCRIPTION AND OPERATION

#### FUEL REQUIREMENTS

Your engine is designed to meet all emissions regulations and provide excellent fuel economy and performance when using high quality unleaded gasoline having an octane rating of 87. The use of premium gasoline is not recommended. The use of premium gasoline will provide no benefit over high quality regular gasoline, and in some circumstances may result in poorer performance.

Light spark knock at low engine speeds is not harmful to your engine. However, continued heavy spark knock at high speeds can cause damage and immediate service is required. Engine damage result-

ing from operation with a heavy spark knock may not be covered by the new vehicle warranty.

Poor quality gasoline can cause problems such as hard starting, stalling and hesitations. If you experience these symptoms, try another brand of gasoline before considering service for the vehicle.

Over 40 auto manufacturers world-wide have issued and endorsed consistent gasoline specifications (the Worldwide Fuel Charter, WWFC) to define fuel properties necessary to deliver enhanced emissions, performance and durability for your vehicle. We recommend the use of gasolines that meet the WWFC specifications if they are available.



**DESCRIPTION AND OPERATION (Continued)****REFORMULATED GASOLINE**

Many areas of the country require the use of cleaner burning gasoline referred to as "reformulated" gasoline. Reformulated gasoline contain oxygenates, and are specifically blended to reduce vehicle emissions and improve air quality.

We strongly supports the use of reformulated gasoline. Properly blended reformulated gasoline will provide excellent performance and durability for the engine and fuel system components.

**GASOLINE/OXYGENATE BLENDS**

Some fuel suppliers blend unleaded gasoline with oxygenates such as 10% ethanol, MTBE, and ETBE. Oxygenates are required in some areas of the country during the winter months to reduce carbon monoxide emissions. Fuels blended with these oxygenates may be used in your vehicle.

**CAUTION: DO NOT use gasoline containing METHANOL. Gasoline containing methanol may damage critical fuel system components.**

**MMT IN GASOLINE**

MMT is a manganese-containing metallic additive that is blended into some gasoline to increase octane. Gasoline blended with MMT provide no performance advantage beyond gasoline of the same octane number without MMT. Gasoline blended with MMT reduce spark plug life and reduce emission system performance in some vehicles. We recommend that gasolines free of MMT be used in your vehicle. The MMT content of gasoline may not be indicated on the gasoline pump; therefore, you should ask your gasoline retailer whether or not his/her gasoline contains MMT.

It is even more important to look for gasoline without MMT in Canada because MMT can be used at levels higher than allowed in the United States. MMT is prohibited in Federal and California reformulated gasoline.

**SULFUR IN GASOLINE**

If you live in the northeast United States, your vehicle may have been designed to meet California low emission standards with Cleaner-Burning California reformulated gasoline with low sulfur. If such fuels are not available in states adopting California emission standards, your vehicles will operate satisfactorily on fuels meeting federal specifications, but emission control system performance may be adversely affected. Gasoline sold outside of California is permitted to have higher sulfur levels which may affect the performance of the vehicle's catalytic converter. This may cause the Malfunction Indicator Lamp (MIL), Check Engine or Service Engine Soon

light to illuminate. We recommend that you try a different brand of unleaded gasoline having lower sulfur to determine if the problem is fuel related prior to returning your vehicle to an authorized dealer for service.

**CAUTION: If the Malfunction Indicator Lamp (MIL), Check Engine or Service Engine Soon light is flashing, immediate service is required; see on-board diagnostics system section.**

**MATERIALS ADDED TO FUEL**

All gasoline sold in the United States and Canada are required to contain effective detergent additives. Use of additional detergents or other additives is not needed under normal conditions.

**FUEL SYSTEM CAUTIONS**

**CAUTION: Follow these guidelines to maintain your vehicle's performance:**

- The use of leaded gas is prohibited by Federal law. Using leaded gasoline can impair engine performance, damage the emission control system, and could result in loss of warranty coverage.
- An out-of-tune engine, or certain fuel or ignition malfunctions, can cause the catalytic converter to overheat. If you notice a pungent burning odor or some light smoke, your engine may be out of tune or malfunctioning and may require immediate service. Contact your dealer for service assistance.
- When pulling a heavy load or driving a fully loaded vehicle when the humidity is low and the temperature is high, use a premium unleaded fuel to help prevent spark knock. If spark knock persists, lighten the load, or engine piston damage may result.
- The use of fuel additives which are now being sold as octane enhancers is not recommended. Most of these products contain high concentrations of methanol. Fuel system damage or vehicle performance problems resulting from the use of such fuels or additives is not the responsibility of Daimler-Chrysler Corporation and may not be covered under the new vehicle warranty.

**NOTE: Intentional tampering with emissions control systems can result in civil penalties being assessed against you.**

**GASOLINE/OXYGENATE BLENDS****DESCRIPTION**

Some fuel suppliers blend unleaded gasoline with materials that contain oxygen such as alcohol, MTBE

## DESCRIPTION AND OPERATION (Continued)

(Methyl Tertiary Butyl Ether) and ETBE (Ethyl Tertiary Butyl Ether). Oxygenates are required in some areas of the country during winter months to reduce carbon monoxide emissions. The type and amount of oxygenate used in the blend is important.

The following are generally used in gasoline blends:

**Ethanol** - (Ethyl or Grain Alcohol) properly blended, is used as a mixture of 10 percent ethanol and 90 percent gasoline. Gasoline blended with ethanol may be used in your vehicle.

**MTBE/ETBE** - Gasoline and MTBE (Methyl Tertiary Butyl Ether) blends are a mixture of unleaded gasoline and up to 15 percent MTBE. Gasoline and ETBE (Ethyl Tertiary Butyl Ether) are blends of gasoline and up to 17 percent ETBE. Gasoline blended with MTBE or ETBE may be used in your vehicle.

**Methanol** - Methanol (Methyl or Wood Alcohol) is used in a variety of concentrations blended with unleaded gasoline. You may encounter fuels containing 3 percent or more methanol along with other alcohols called cosolvents.

### DO NOT USE GASOLINE CONTAINING METHANOL.

Use of methanol/gasoline blends may result in starting and driveability problems and damage critical fuel system components.

Problems that are the result of using methanol/gasoline blends are not the responsibility of Chrysler Corporation and may not be covered by the vehicle warranty.

#### Reformulated Gasoline

Many areas of the country are requiring the use of cleaner-burning fuel referred to as **Reformulated Gasoline**. Reformulated gasoline are specially blended to reduce vehicle emissions and improve air quality.

Chrysler Corporation strongly supports the use of reformulated gasoline whenever available. Although your vehicle was designed to provide optimum performance and lowest emissions operating on high quality unleaded gasoline, it will perform equally well and produce even lower emissions when operating on reformulated gasoline.

#### Materials Added to Fuel

Indiscriminate use of fuel system cleaning agents should be avoided. Many of these materials intended for gum and varnish removal may contain active solvents of similar ingredients that can be harmful to fuel system gasket and diaphragm materials.

## FUEL DELIVERY SYSTEM

### DESCRIPTION

The front wheel drive car uses a plastic fuel tank located rear center of the vehicle.

The in-tank fuel pump module contains the fuel pump and pressure regulator. The pump is serviced as part of the fuel pump module. Refer to Fuel Pump Module.

The fuel delivery system consists of:

- the fuel pump module containing the electric fuel pump, fuel filter/fuel pressure regulator, fuel gauge sending unit (fuel level sensor) and a separate fuel filter located at bottom of pump module

- Fuel tubes/lines/hoses
- Quick-connect fittings
- Fuel injector rail
- Fuel injectors
- Fuel tank
- Fuel tank filler/vent tube assembly
- Fuel tank filler tube cap

The fuel delivery system contains a replaceable in-line filter. The filter attaches to the frame above the rear of the fuel tank.

### OPERATION

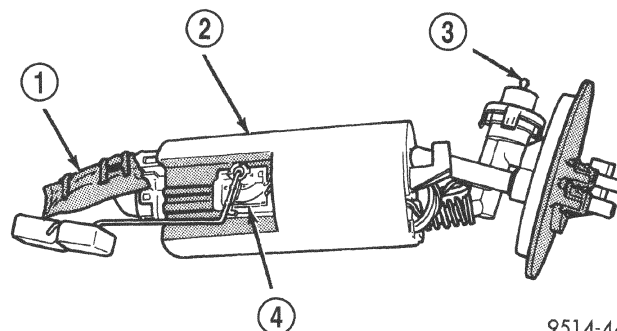
A returnless fuel system is used on all vehicles. Fuel is returned through the fuel pump module and back to the fuel tank. A separate fuel return line from the tank to the engine is no longer used.

Relieve fuel system pressure before servicing fuel system components. Refer to the Fuel System Pressure Release Procedure and follow all Cautions and Warnings. Most fuel system components attach to the fuel lines with quick connect fittings. Refer to Quick Connect Fittings in this section.

## FUEL PUMP MODULE

### DESCRIPTION

The fuel pump module is installed in the top of the fuel tank (Fig. 1).



9514-44

**Fig. 1 Fuel Pump Module**

- 1 - INLET STRAINER
- 2 - FUEL RESERVOIR
- 3 - FUEL PRESSURE REGULATOR
- 4 - FUEL LEVEL SENSOR

The fuel pump module contains the following:



**DESCRIPTION AND OPERATION (Continued)**

- Electric fuel pump
- Fuel pump reservoir
- Inlet strainer
- Fuel pressure regulator
- Fuel gauge sending unit
- Fuel supply line connection

**The inlet strainer, fuel pressure regulator and fuel level sensor are the only serviceable items. If the fuel pump or electrical wiring harness requires service, replace the fuel pump module.**

The electric fuel pump is located in and is part of the fuel pump module. It is a positive displacement, gerotor type, immersible pump with a permanent magnet electric motor.

**OPERATION**

The pump draws fuel through a strainer and pushes it through the motor to the outlet. The pump contains one check valve. The check valve, in the pump outlet, maintains pump pressure during engine off conditions. The fuel pump relay provides voltage to the fuel pump.

The fuel pump has a maximum deadheaded pressure output of approximately 635 kPa (95 psi). The regulator adjusts fuel system pressure to approximately 338 kPa (49 psi).

**FUEL PUMP ELECTRICAL CONTROL**

Voltage to operate the electric pump is supplied through the fuel pump relay. For an electrical operational description of the fuel pump refer to fuel Pump Relay—PCM Output.

**ELECTRICAL PUMP REPLACEMENT**

The electric fuel pump is not serviceable. If the fuel pump or electrical wiring harness needs replacement, the complete fuel pump module must be replaced. Perform the Fuel System Pressure Release procedure before servicing the fuel pump.

**FUEL LEVEL SENSOR****DESCRIPTION**

The level sensor is attached to the side of the fuel pump module. The level sensor consists of a float, an arm, and a variable resistor.

**OPERATION**

As the fuel level increases, the float and arm move up. This decreases the sending unit resistance, causing the fuel gauge on the instrument panel to read full. The fuel level sensor (fuel gauge sending unit) sends a signal to the PCM to indicate fuel level. The purpose of this feature is to prevent a false setting of misfire and fuel system monitor trouble codes if the

fuel level is less than approximately 15 percent of its rated capacity. It is also used to send a signal for fuel gauge operation via the PCI bus circuits.

**FUEL TANK****DESCRIPTION**

The fuel tank is constructed of a plastic material. Its main functions are for fuel storage and for placement of the fuel pump module. The tank is made from High density Polyethylene (HDPE) material.

**OPERATION**

All models pass a full 360 degree rollover test without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections.

All models are equipped with either one or two rollover valves mounted into the top of the fuel tank (or pump module).

An evaporation control system is connected to the rollover valve(s) to reduce emissions of fuel vapors into the atmosphere. When fuel evaporates from the fuel tank, vapors pass through vent hoses or tubes to a charcoal canister where they are temporarily held. When the engine is running, the vapors are drawn into the intake manifold. Certain models are also equipped with a self-diagnosing system using a Leak Detection Pump (LDP). Refer to the Emission Control System for additional information.

**FUEL INJECTORS****DESCRIPTION**

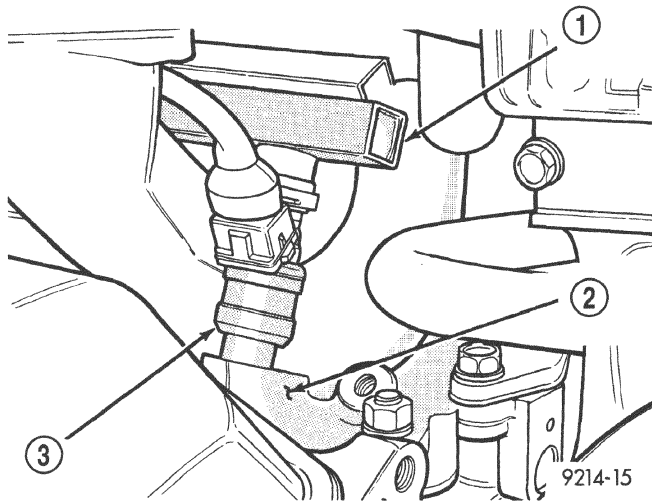
The injectors are positioned in the intake manifold with the nozzle ends directly above the intake valve port (Fig. 2).

**OPERATION**

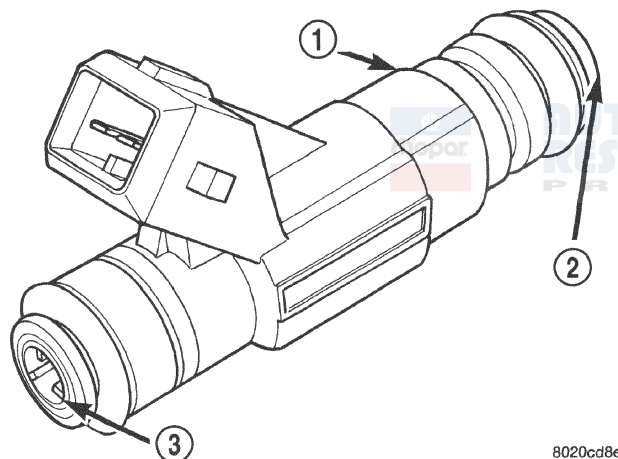
The fuel injectors are electrical solenoids (Fig. 3). The injector contains a pintle that closes off an orifice at the nozzle end. When electric current is supplied to the injector, the armature and needle move a short distance against a spring, allowing fuel to flow out the orifice. Because the fuel is under high pressure, a fine spray is developed in the shape of a hollow cone. The spraying action atomizes the fuel, adding it to the air entering the combustion chamber. Fuel injectors are not interchangeable between engines.

**FUEL PRESSURE REGULATOR****OPERATION**

The fuel system uses a nonadjustable pressure regulator that maintains fuel system pressure at

**DESCRIPTION AND OPERATION (Continued)****Fig. 2 Fuel Injector Location—Typical**

- 1 - FUEL RAIL
- 2 - INTAKE MANIFOLD
- 3 - FUEL INJECTORS

**Fig. 3 Fuel Injector**

- 1 - FUEL INJECTOR
- 2 - NOZZLE
- 3 - TOP (FUEL ENTRY)

approximately 338 kPa (49 psi). The fuel pressure regulator contains a diaphragm, calibrated spring and a fuel return valve. The spring pushes down on the diaphragm and closes off the fuel return port. System fuel pressure reflects the amount of fuel pressure required to open the return port.

The pressure regulator is a mechanical device that is NOT controlled by the PCM or engine vacuum.

**PRESSURE-VACUUM FILLER CAP****OPERATION**

The loss of any fuel or vapor out of the filler tube neck is prevented by the use of a safety filler cap. The cap releases only under significant pressure 17 kPa (2.5 psi). The vacuum release for all gas caps is between 2.0 and 3.0 kPa (.29 and .43 psi). The cap must be replaced by a similar unit in order for the system to remain effective.

**WARNING: REMOVE FUEL FILLER TUBE CAP TO RELIEVE TANK PRESSURE BEFORE REMOVING OR REPAIRING FUEL SYSTEM COMPONENTS.**

**NOTE: THE MALFUNCTION INDICATOR LAMP COULD BE TURNED ON IF THE FUEL FILLER CAP IS LOOSE OR MISSING.**

**ONBOARD REFUELING VAPOR RECOVERY (ORVR)****DESCRIPTION**

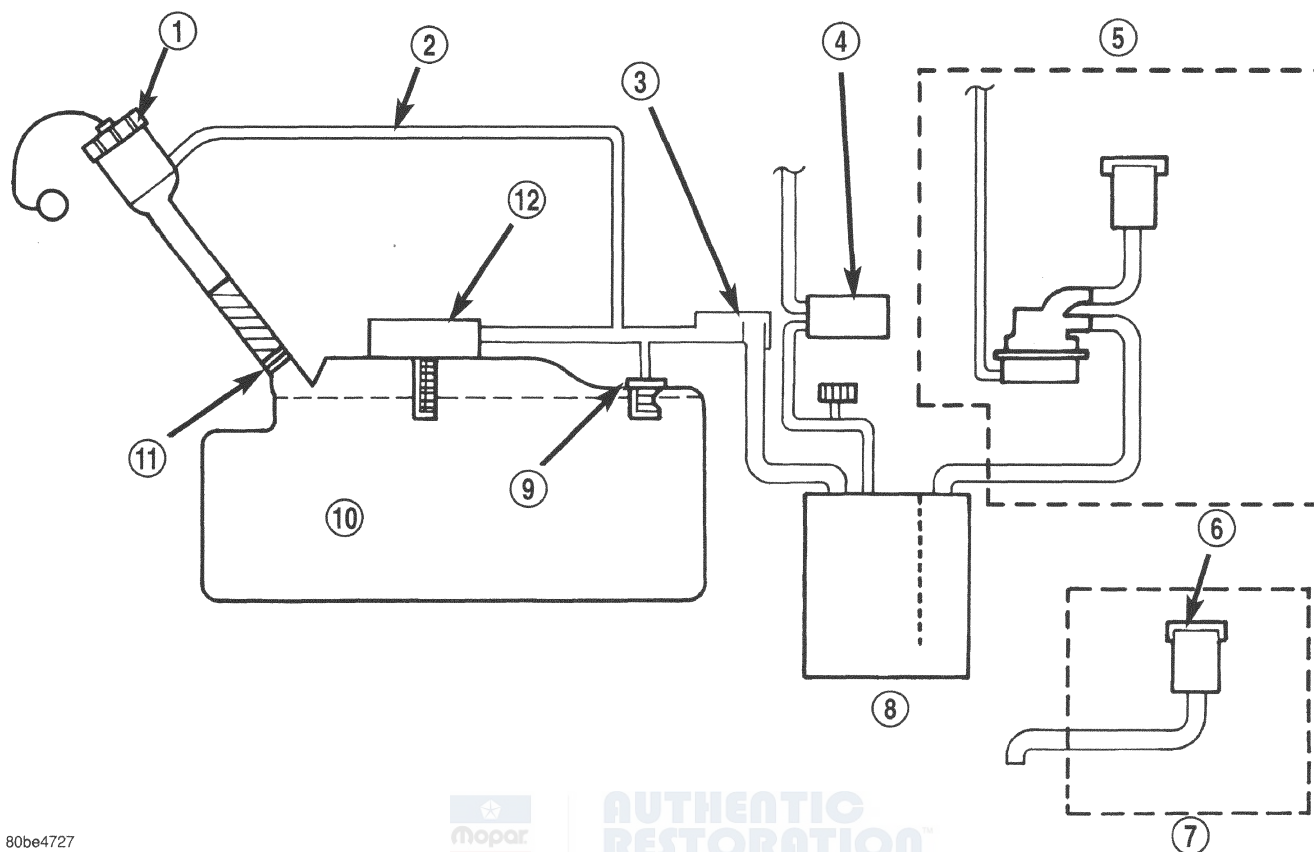
ORVR System Schematic and components.

**OPERATION**

The emission control principle used in the ORVR system is that the fuel flowing into the filler tube (appx. 1" I. D.) creates an aspiration effect which draws air into the fill tube (Fig. 4). During refueling, the fuel tank is vented to the vapor canister to capture escaping vapors. With air flowing into the filler tube, there are no fuel vapors escaping to the atmosphere. Once the refueling vapors are captured by the canister, the vehicle's computer controlled purge system draws vapor out of the canister for the engine to burn. The vapors flow is metered by the purge solenoid so that there is no or minimal impact on driveability or tailpipe emissions.

As fuel starts to flow through the fill tube, it opens the normally closed check valve and enters the fuel tank. Vapor or air is expelled from the tank through the control valve to the vapor canister. Vapor is absorbed in the canister until vapor flow in the lines stops, either following shut-off or by having the fuel level in the tank rise high enough to close the control valve. The control valve contains a float that rises to seal the large diameter vent path to the canister. At this point in the fueling of the vehicle, the tank pressure increases, the check valve closes (preventing tank fuel from spitting back at the operator), and fuel then rises up the filler tube to shut-off the dispensing nozzle.



**DESCRIPTION AND OPERATION (Continued)**

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**Fig. 4 ORVR System Schematic**

- 1 - FUEL CAP
- 2 - RECIRCULATION TUBE
- 3 - LIQUID SEPARATOR
- 4 - PURGE
- 5 - W/LDP
- 6 - BREATHER ELEMENT

- 7 - W/O LDP
- 8 - CANISTER
- 9 - ROLLOVER VALVE
- 10 - FUEL TANK
- 11 - CHECK VALVE
- 12 - CONTROL VALVE

If the engine is shut-off while the On-Board diagnostics test is running, low level tank pressure can be trapped in the fuel tank and fuel can not be added to the tank until the pressure is relieved. This is due to the leak detection pump closing the vapor outlet from the top of the tank and the one-way check valve not allowing the tank to vent through the fill tube to atmosphere. Therefore, when fuel is added, it will back-up in the fill tube and shut off the dispensing nozzle. The pressure can be eliminated in two ways: 1. Vehicle purge must be activated and for a long enough period to eliminate the pressure. 2. Removing the fuel cap and allowing enough time for the system to vent thru the recirculation tube.

**CONTROL VALVE****DESCRIPTION**

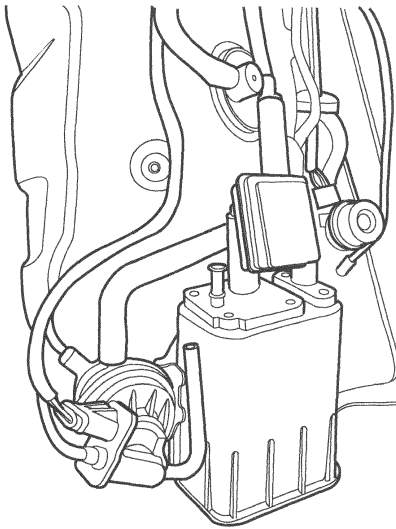
It is a valve in the top of the fuel tank that controls fuel fill rate and fuel fill level and directs vapors to a storage area.

**OPERATION**

The valve controls the fuel fill rate and set the fuel level in the fuel tank. It also allows the proper operation of OBDII leak detection monitor. It prevent liquid fuel carry over into the EVAP system (Fig. 5).

**ROLLOVER VALVES****DESCRIPTION**

All vehicles have rollover valve(s) on top of the fuel tank.

**DESCRIPTION AND OPERATION (Continued)**

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**Fig. 5 ORVR System****OPERATION**

The valves prevent fuel flow through the fuel tank vent valve hoses should the vehicle rollover.

The rollover valves on the fuel tank are not serviceable.



AUTHENTIC  
RESTORATION  
PRODUCT

**FUEL TUBES/LINES/HOSES AND CLAMPS****DESCRIPTION**

Also refer to Quick-Connect Fittings.

**WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE IN THIS GROUP.**

The lines/tubes/hoses used on fuel injected vehicles are of a special construction. This is due to the higher fuel pressures and the possibility of contaminated fuel in this system. If it is necessary to replace these lines/tubes/hoses, only those marked EFM/EFI may be used.

**If equipped:** The hose clamps used to secure rubber hoses on fuel injected vehicles are of a special rolled edge construction. This construction is used to prevent the edge of the clamp from cutting into the hose. Only these rolled edge type clamps may be used in this system. All other types of clamps may cut into the hoses and cause high-pressure fuel leaks.

Use new original equipment type hose clamps.

**VEHICLE DOES NOT FILL**

Pre-Mature Nozzle Shut-Off.	Defective fuel tank assembly components.	Fill tube improperly installed (sump).
		Fill tube hose pinched.
		Check valve stuck shut.
		Control valve stuck shut.
	Defective vapor/vent components.	Vent line from control valve to canister pinched
		Vent line from canister to vent filter pinched.
		Canister vent valve failure (Requires double failure, plugged to LDP and atmosphere).
		Leak detection pump failed closed.
		Leak detection pump filter plugged.
	On-Board diagnostics evaporative system leak test just conducted.	Canister vent valve vent plugged to atmosphere.
		Engine still running when attempting to fill (System designed not to fill).
Fuel Spits Out Of Filler Tube.	Defective fill nozzle.	
	During fill.	See Pre-Mature Shut-Off
	At conclusion of fill.	Defective fuel handling component. (Check valve stuck open).
		Defective vapor/vent handling component
		Defective fill nozzle

## SERVICE PROCEDURES

### FUEL SYSTEM PRESSURE RELEASE PROCEDURE

- (1) Remove Fuel Pump relay from Power Distribution Center (PDC). For location of relay, refer to label on underside of PDC cover.
- (2) Start and run engine until it stalls.
- (3) Attempt restarting engine until it will no longer run.
- (4) Turn ignition key to OFF position.

**CAUTION:** Steps 1, 2, 3 and 4 must be performed to relieve high pressure fuel from within fuel rail. Do not attempt to use following steps to relieve this pressure as excessive fuel will be forced into a cylinder chamber.

- (5) Place a rag or towel below fuel line quick-connect fitting at fuel rail.
- (6) Return fuel pump relay to PDC.
- (7) One or more Diagnostic Trouble Codes (DTC's) may have been stored in PCM memory due to fuel pump relay removal. The DRB III® scan tool must be used to erase a DTC.

### FUEL TANK DRAINING

- (1) Remove fuel cap slowly to release tank pressure.
- (2) With vehicle on a hoist, drain fuel from tank.
- (3) Position a fuel approved container, with a capacity of at least 16 gallons, under the drain plug located on the bottom left edge of the tank.

**CAUTION:** Use a Back-Up wrench on tank to remove drain plug.

- (4) Remove drain plug and allow fuel to drain (Fig. 6).

**WARNING:** DRAIN PLUG MUST BE INSTALLED AT THIS TIME AS THERE WILL BE 1 TO 2 GALLONS OF FUEL LEFT IN THE TANK.

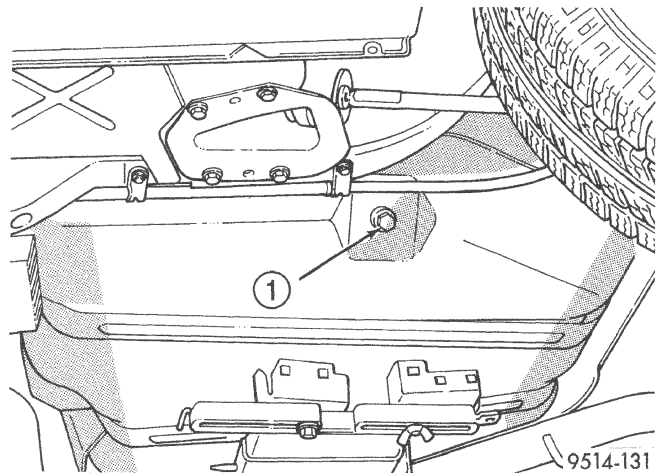
- (5) When tank is no longer draining, install drain plug. Tighten plug to 32 in. lbs.

### HOSES AND CLAMPS

Inspect all hose connections (clamps and quick connect fittings) for completeness and leaks. Replace cracked, scuffed, or swelled hoses. Replace hoses that rub against other vehicle components or show sign of wear.

Fuel injected vehicles use specially constructed hoses. When replacing hoses, only use hoses marked EFM/EFI.

When installing hoses, ensure that they are routed away from contact with other vehicle components



**Fig. 6 Fuel Tank Drain Plug**

1 - FUEL TANK DRAIN PLUG

that could rub against them and cause failure. Avoid contact with clamps or other components that cause abrasions or scuffing. Ensure that rubber hoses are properly routed and avoid heat sources.

The hose clamps have rolled edges to prevent the clamp from cutting into the hose. Only use clamps that are original equipment or equivalent. Other types of clamps may cut into the hoses and cause high pressure fuel leaks. Tighten hose clamps to 1 N·m (10 in. lbs.) torque.

Inspect all hose connections such as clamps, couplings and fittings to make sure they are secure and leaks are not present. The component should be replaced immediately if there is any evidence of degradation that could result in failure.

Never attempt to repair a plastic fuel line/tube. Replace as necessary.

Avoid contact of any fuel tubes/hoses with other vehicle components that could cause abrasions or scuffing. Be sure that the plastic fuel lines/tubes are properly routed to prevent pinching and to avoid heat sources.

## QUICK-CONNECT FITTINGS

### REMOVAL

When disconnecting a quick-connect fitting, the retainer will remain on the fuel tube nipple.

**WARNING:** RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING A QUICK-CONNECT FITTINGS. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE.

- (1) Perform Fuel Pressure Release Procedure. Refer to the Fuel Pressure Release Procedure in this section.



## SERVICE PROCEDURES (Continued)

(2) Disconnect negative cable from battery or auxiliary jumper terminal.

(3) Squeeze retainer tabs together and pull fuel tube/quick-connect fitting assembly off of fuel tube nipple. The retainer will remain on fuel tube.

## INSTALLATION

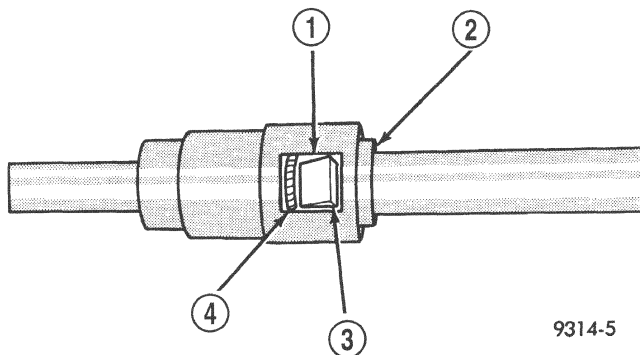
**CAUTION:** Never install a quick-connect fitting without the retainer being either on the fuel tube or already in the quick-connect fitting. In either case, ensure the retainer locks securely into the quick-connect fitting by firmly pulling on fuel tube and fitting to ensure it is secured.

(1) Using a clean lint free cloth, clean the fuel tube nipple and retainer.

(2) Prior to connecting the fitting to the fuel tube, coat the fuel tube nipple with clean 30 weight engine oil.

(3) Push the quick-connect fitting over the fuel tube until the **retainer seats and a click is heard**.

(4) The plastic quick-connect fitting has windows in the sides of the casing. When the fitting completely attaches to the fuel tube, the retainer locking ears and the fuel tube shoulder are visible in the windows. If they are not visible, the retainer was not properly installed (Fig. 7). **Do not rely upon the audible click to confirm a secure connection.**



**Fig. 7 Plastic Quick-Connect Fitting/Fuel Tube Connection**

- 1 - WINDOW
- 2 - TAB (2)
- 3 - EAR
- 4 - SHOULDER (ON TUBE)

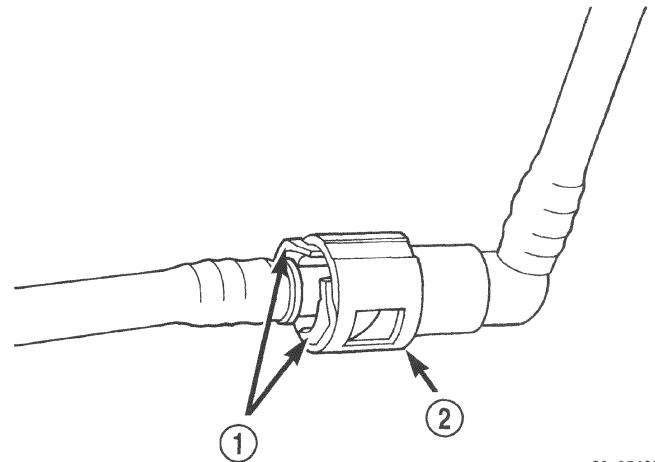
(5) Connect negative cable to battery or auxiliary jumper terminal.

**CAUTION:** When using the ASD Fuel System Test, the Auto Shutdown (ASD) Relay remains energized for several minutes, until the test is stopped, or until the ignition switch is turned to the Off position.

(6) Use the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

## TWO-TAB TYPE FITTING

This type of fitting is equipped with tabs located on both sides of the fitting (Fig. 8). These tabs are supplied for disconnecting the quick-connect fitting from component being serviced.



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**Fig. 8 Typical Two-Tab Type Quick-Connect Fitting**

- 1 - TAB(S)
- 2 - QUICK-CONNECT FITTING

**CAUTION:** The interior components (O-rings, spacers) of this type of quick-connect fitting are not serviced separately, but new plastic retainers are available. Do not attempt to repair damaged fittings or fuel lines/tubes. If repair is necessary, replace the complete fuel tube assembly.

**WARNING:** THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE IN THIS GROUP.

## DISCONNECTION/CONNECTION

(1) Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure in this group.

(2) Disconnect negative battery cable from battery or auxiliary jumper terminal.

(3) Clean fitting of any foreign material before disassembly.

(4) To disconnect quick-connect fitting, squeeze plastic retainer tabs (Fig. 8) against sides of quick-connect fitting with your fingers. Tool use is not required for removal and may damage plastic



**SERVICE PROCEDURES (Continued)**

retainer. Pull fitting from fuel system component being serviced. The plastic retainer will remain on component being serviced after fitting is disconnected. The O-rings and spacer will remain in quick-connect fitting connector body.

(5) Inspect quick-connect fitting body and component for damage. Replace as necessary.

**CAUTION:** When the quick-connect fitting was disconnected, the plastic retainer will remain on the component being serviced. If this retainer must be removed, very carefully release the retainer from the component with two small screwdrivers. After removal, inspect the retainer for cracks or any damage.

(6) Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.

(7) Insert quick-connect fitting to component being serviced and into plastic retainer. When a connection is made, a click will be heard.

(8) Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).

(9) Connect negative cable to battery or auxiliary jumper terminal.

(10) Use the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

**PLASTIC RETAINER RING TYPE FITTING**

This type of fitting can be identified by the use of a full-round plastic retainer ring (Fig. 9) usually black in color.

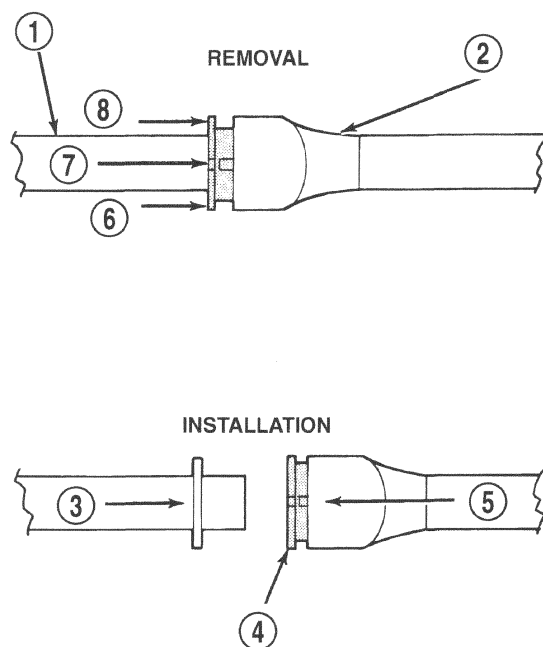
**CAUTION:** The interior components (O-rings, spacers, retainers) of this type of quick-connect fitting are not serviced separately. Do not attempt to repair damaged fittings or fuel lines/tubes. If repair is necessary, replace the complete fuel tube assembly.

**WARNING:** THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE IN THIS GROUP.

**DISCONNECTION/CONNECTION**

(1) Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure in this section.

(2) Disconnect negative battery cable from battery or auxiliary jumper terminal.



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**Fig. 9 Plastic Retainer Ring Type Fitting**

- 1 - FUEL TUBE
- 2 - QUICK CONNECT FITTING
- 3 - PUSH
- 4 - PLASTIC RETAINER
- 5 - PUSH
- 6 - PUSH
- 7 - PUSH
- 8 - PUSH

(3) Clean fitting of any foreign material before disassembly.

(4) To release fuel system component from quick-connect fitting, firmly push fitting towards component being serviced while firmly pushing plastic retainer ring into fitting (Fig. 9). With plastic ring depressed, pull fitting from component. **The plastic retainer ring must be pressed squarely into fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on shoulder of plastic retainer ring to aid in disconnection.**

(5) After disconnection, plastic retainer ring will remain with quick-connect fitting connector body.

(6) Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.

(7) Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.

(8) Insert quick-connect fitting into component being serviced until a click is felt.

(9) Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).

## SERVICE PROCEDURES (Continued)

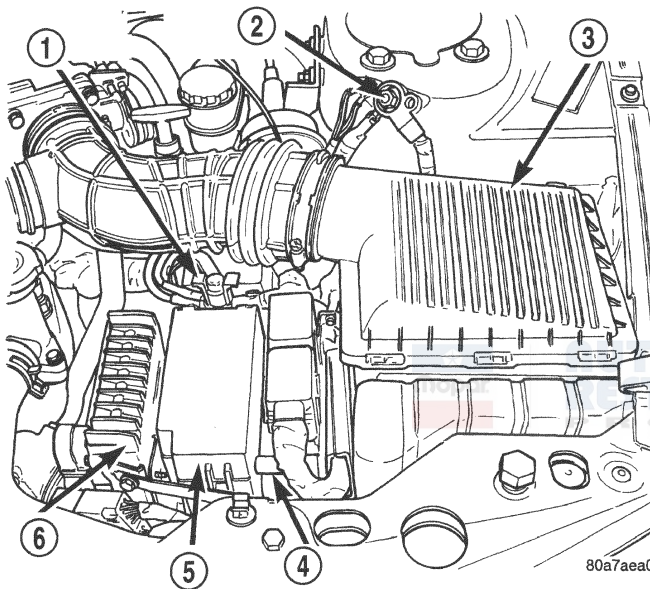
(10) Connect negative battery cable to battery or auxiliary jumper terminal.

(11) Use the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

## REMOVAL AND INSTALLATION

### AUTOMATIC SHUTDOWN RELAY

The relay is located in the Power Distribution Center (PDC) (Fig. 10). For the location of the relay within the PDC, refer to the PDC cover for location. Check electrical terminals for corrosion and repair as necessary.



**Fig. 10 Power Distribution Center (PDC)**

- 1 - BATTERY POSITIVE
- 2 - BATTERY GROUND
- 3 - AIR CLEANER
- 4 - PCM
- 5 - PDC
- 6 - TCM

### FUEL PUMP RELAY

The fuel pump relay is located in the PDC. The inside top of the PDC cover has a label showing relay and fuse location.

### FUEL PUMP MODULE

**WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.**

### REMOVAL

(1) Remove fuel filler cap and perform Fuel System Pressure Release procedure.

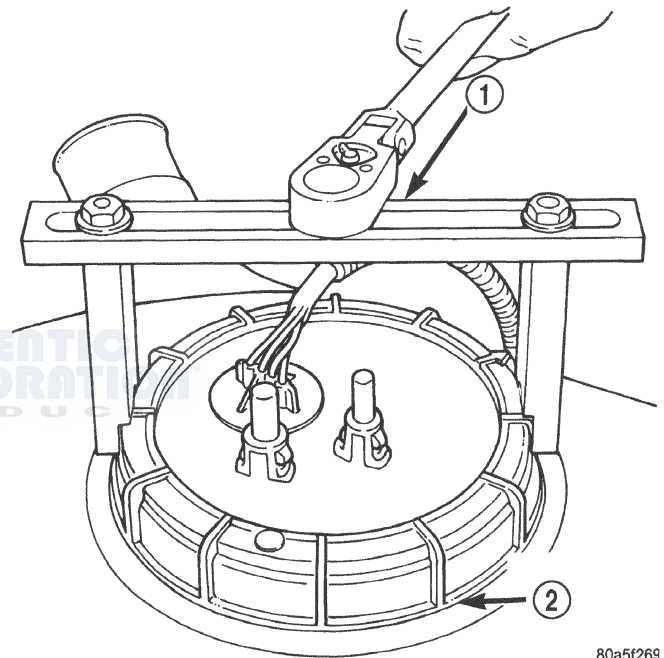
(2) Disconnect negative cable from auxiliary jumper terminal.

(3) Remove fuel tank, refer to the Fuel Tank removal section.

(4) Disconnect fuel filter lines from fuel pump module.

(5) Clean top of tank to remove loose dirt and debris.

(6) Using Special Tool #6856 Fuel Pump Module Ring Spanner, remove locknut to release pump module (Fig. 11).



**Fig. 11 Fuel Pump Module Locknut**

- 1 - SPECIAL TOOL 6856
- 2 - FUEL PUMP MODULE LOCK RING

**WARNING: THE FUEL RESERVOIR OF THE FUEL PUMP MODULE DOES NOT EMPTY OUT WHEN THE TANK IS DRAINED. THE FUEL IN THE RESERVOIR MAY SPILL OUT WHEN THE MODULE IS REMOVED.**

(7) Remove fuel pump module and O-ring from tank (Fig. 12). Discard O-ring.

### INSTALLATION

(1) Wipe seal area of tank clean. Place a new O-ring on the ledge between the tank threads and the pump module opening.

(2) Position fuel pump module in tank. Make sure the alignment tab on the underside of the pump module flange sits in the corresponding notch in the fuel tank.

## REMOVAL AND INSTALLATION (Continued)

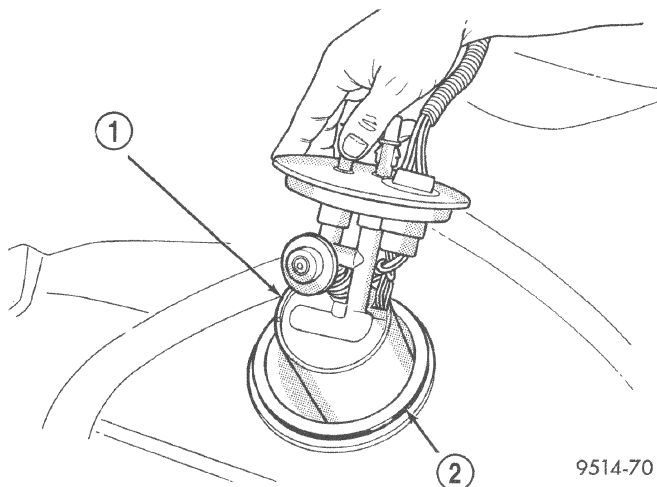


Fig. 12 Fuel Pump Module Removal

- 1 - FUEL PUMP MODULE  
2 - O-RING

**CAUTION:** Over tightening the pump lock ring may result in a leak.

(3) While holding the pump module in position, install locknut. Tighten locknut to 74.5 N·m (55 ft. lbs) torque using special tool #6856.

(4) Install fuel tank and fuel filter, refer to the Fuel Tank installation section.

(5) Install negative cable to auxiliary jumper terminal.

(6) Fill fuel tank with clean fuel. Use the DRB scan tool to pressurize the system and check for leaks.

## FUEL FILTER

The fuel filter mounts to the frame above the rear of the fuel tank. The inlet and outlet tubes are permanently attached to the filter.

## REMOVAL

**WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE DISCONNECTING QUICK-CONNECT FITTINGS AT FUEL FILTER AND FUEL PUMP MODULE. REFER TO THE FUEL PRESSURE RELEASE PROCEDURE**

- (1) Remove rear seat.
- (2) Disconnect fuel pump electrical connector. Push grommet out and feed jumper completely through hole in body.
- (3) Remove fuel cap slowly to release tank pressure.
- (4) With vehicle on a hoist, drain fuel from tank. Refer to Fuel Tank Draining in this section.
- (5) Remove driver's side fuel tank strap. Loosen, do not remove, passenger side fuel tank strap allowing fuel tank fill neck to touch rear suspension crossmember.

**WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.**

(6) Disconnect fuel lines from fuel pump module (Fig. 13). These are quick connect fittings. Refer to Quick Connect Fittings in this section.

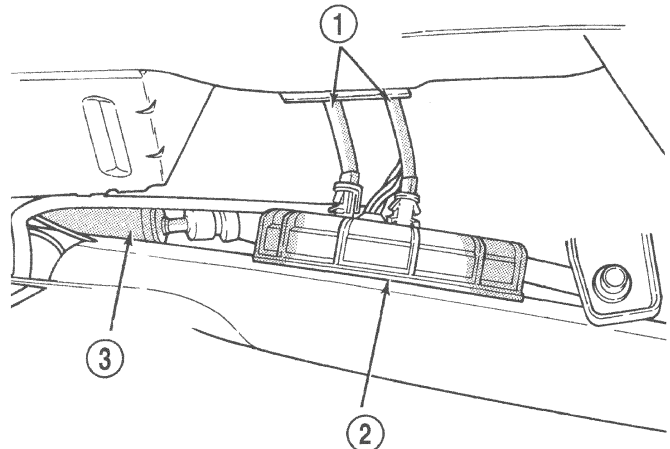


Fig. 13 Fuel Lines at Fuel Pump Module

- 1 - FUEL LINES  
2 - FUEL PUMP MODULE LOCK RING  
3 - FUEL FILTER

(7) Disconnect fuel supply line from the fuel brake module.

(8) Remove fuel filter (Fig. 14).

## INSTALLATION

The fuel supply (to filter) tube, return tube (to pump module) are permanently attached to the fuel filter. The ends of the fuel supply and return tubes have different size quick-connect fittings. The larger quick-connect fitting connects to the large nipple (supply side) on the fuel pump module. The smaller quick-connect fitting attaches to the small nipple (return side) on the fuel pump module.

(1) Apply a light coating of clean 30 weight engine oil to the fuel filter nipples. Install fuel tubes. Refer to Fuel Tubes and Quick-Connect Fittings in this section.

(2) Install fuel tank, filter and tank straps, install the front bolts first and then the rear bolts. Torque tank strap bolts to 23 N·m (250. in. lbs.). **Make sure pump module harness grommet is installed in body as tank is raised into position.**

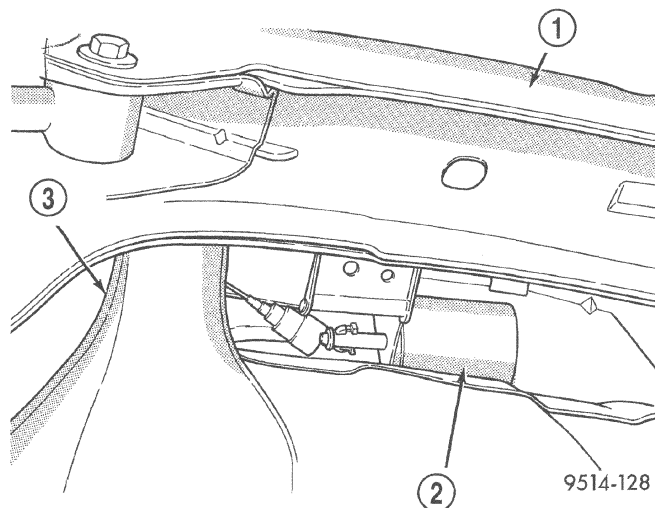
(3) Lower vehicle and connect pump module connector.

(4) Install rear seat.

(5) Fill tank with fuel.

(6) Connect negative cable to auxiliary jumper terminal.



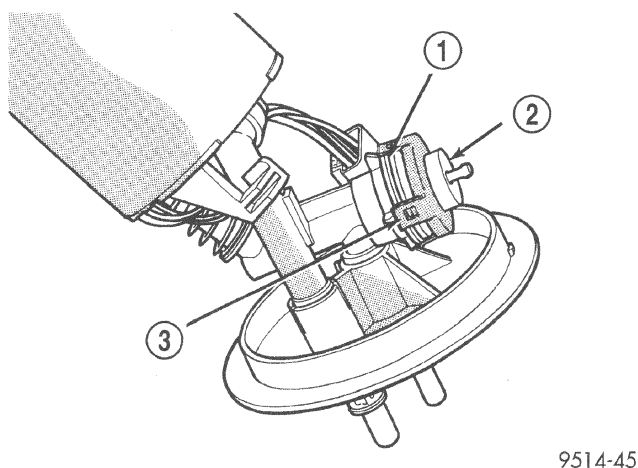
**REMOVAL AND INSTALLATION (Continued)****Fig. 14 Fuel Filter**

- 1 - REAR CROSSMEMBER
- 2 - FUEL FILTER
- 3 - FUEL FILL NECK

(7) Use the DRB scan tool ASD Fuel system test to pressurize the the fuel system. Check for leaks.

**FUEL PRESSURE REGULATOR**

The fuel pressure regulator is part of the fuel pump module (Fig. 15). Remove the fuel pump module from the fuel tank to access the fuel pressure regulator. Refer to the Fuel Pump Module removal in this section.

**Fig. 15 Fuel Pressure Regulator**

- 1 - PRY BETWEEN REGULATOR AND HOUSING
- 2 - FUEL PRESSURE REGULATOR
- 3 - TABS (4)

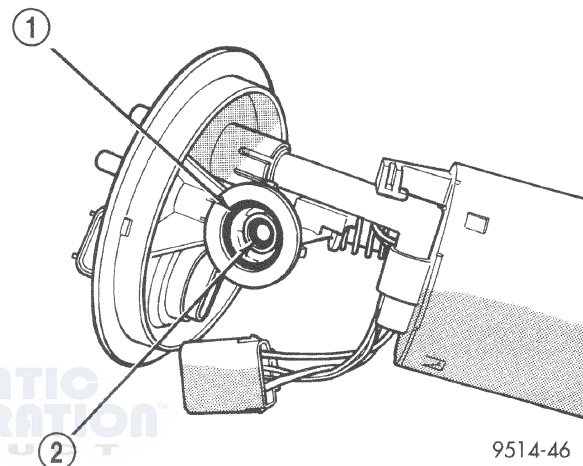
**WARNING: FUEL SYSTEM PRESSURE MUST BE RELEASED BEFORE SERVICING ANY FUEL SYSTEM COMPONENT. PERFORM THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE.**

**REMOVAL**

- (1) Spread tangs on pressure regulator retainer (Fig. 15).
- (2) Pry fuel pressure regulator out of housing.
- (3) Ensure both upper and lower O-rings were removed with regulator.

**INSTALLATION**

- (1) Lightly lubricate the O-rings with clean engine oil and place them into opening in pump module (Fig. 16).
- (2) Push regulator into opening in pump module.
- (3) Fold tangs on regulator retainer over tabs on housing.

**Fig. 16 Fuel Pressure Regulator O-rings**

- 1 - UPPER O-RING
- 2 - LOWER O-RING

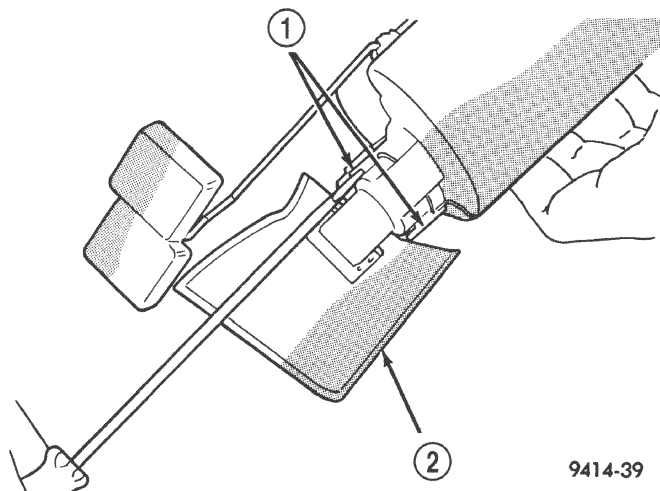
**FUEL PUMP INLET STRAINER****REMOVAL**

- (1) Remove fuel pump module. Refer to Fuel Pump Module Removal in this section.
- (2) Using a thin straight blade screwdriver, carefully pry back the locking tabs on fuel pump reservoir and remove the strainer (Fig. 17).
- (3) Remove strainer O-ring from the fuel pump reservoir body.
- (4) Remove any contaminants by washing the inside of the fuel tank.

**INSTALLATION**

- (1) Lubricate the strainer O-ring with clean motor oil.
- (2) Insert strainer O-ring into outlet of strainer so that it sits evenly on the step inside the outlet.
- (3) Push strainer onto the inlet of the fuel pump reservoir body. Make sure the locking tabs on the reservoir body lock over the locking tangs on the strainer.



**REMOVAL AND INSTALLATION (Continued)****Fig. 17 Inlet Strainer Removal**

- 1 - TABS  
2 - INLET STRAINER

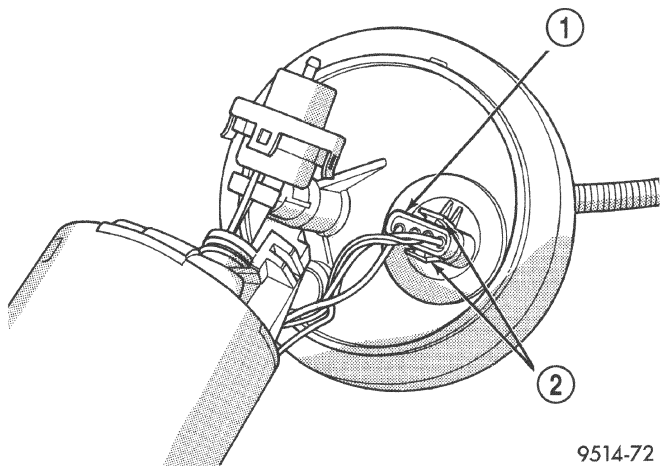
(4) Install fuel pump module. Refer to Fuel Pump Module Installation in this section.

**FUEL LEVEL SENSOR****REMOVAL**

Remove fuel pump module. Refer to Fuel Pump Module in this section.

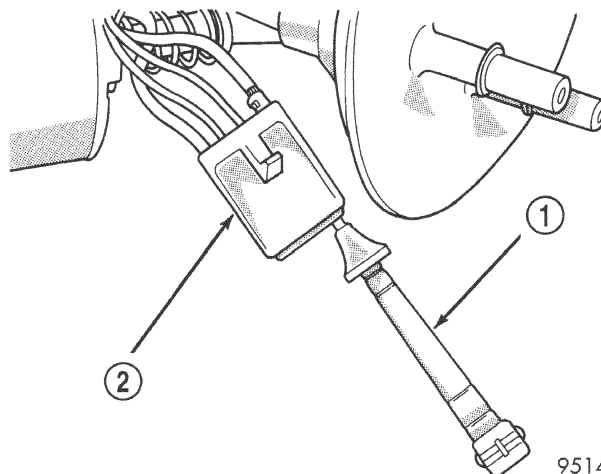
(1) Depress retaining tab and remove the fuel pump/level sensor connector from the **BOTTOM** of the fuel pump module electrical connector (Fig. 18).

**NOTE:** The pump module harness on TOP of flange is not serviceable or removable.

**Fig. 18 Fuel Pump/Level Sensor Electrical Connector**

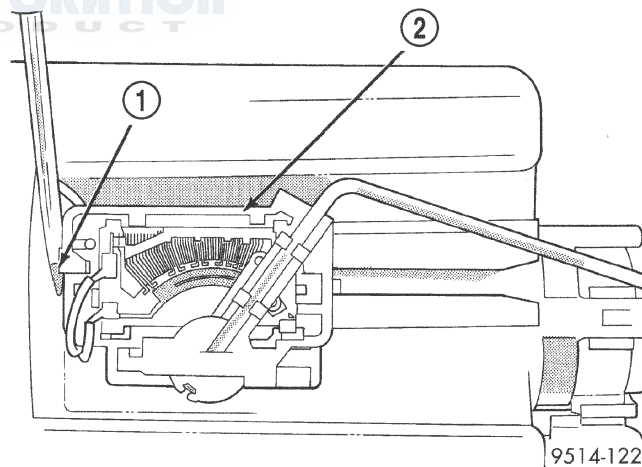
- 1 - ELECTRICAL CONNECTOR  
2 - RETAINING TABS

(2) Using Special Tool C-4334 terminal remover or equivalent, remove terminals from level sensor connector (Fig. 19).

**Fig. 19 Terminal Removal Tool**

- 1 - TERMINAL REMOVAL TOOL  
2 - FUEL LEVEL SENSOR CONNECTOR

(3) Insert a screwdriver between the fuel pump module and the top of the level sensor housing (Fig. 20). Push level sensor down slightly.

**Fig. 20 Loosening Level Sensor**

- 1 - PRY AGAINST LEVEL SENSOR  
2 - LEVEL SENSOR

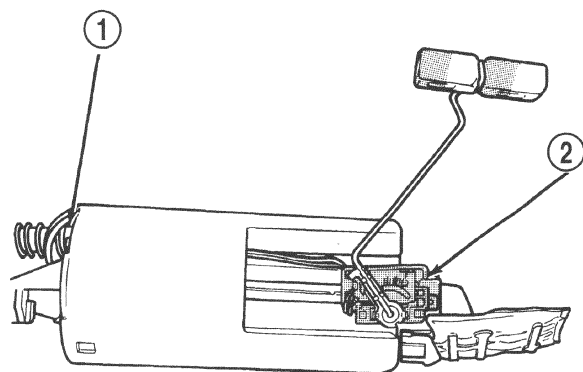
(4) Slide level sensor wires through opening fuel pump module (Fig. 21).

(5) Slide level sensor out of channel in module.

**INSTALLATION**

(1) Insert level sensor wires into bottom of opening in module.

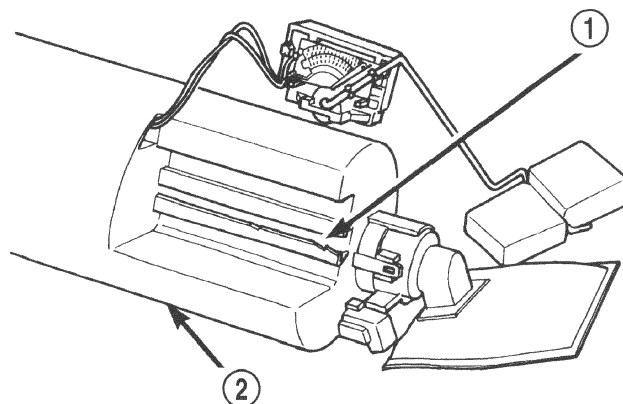
(2) Wrap wires into groove in back of level sensor (Fig. 22).

**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 21 Level Sensor Removal/Installation**

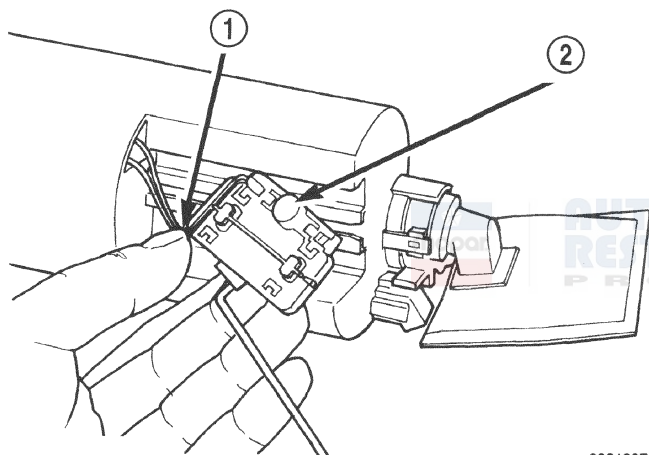
- 1 - OPENING IN MODULE  
2 - FUEL LEVEL SENSOR



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**Fig. 23 Installation Channel**

- 1 - CHANNEL FOR LEVEL SENSOR  
2 - PUMP MODULE



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**Fig. 22 Groove in Back Side of Level Sensor**

- 1 - WRAP WIRES IN GROOVE  
2 - REAR VIEW OF LEVEL SENSOR

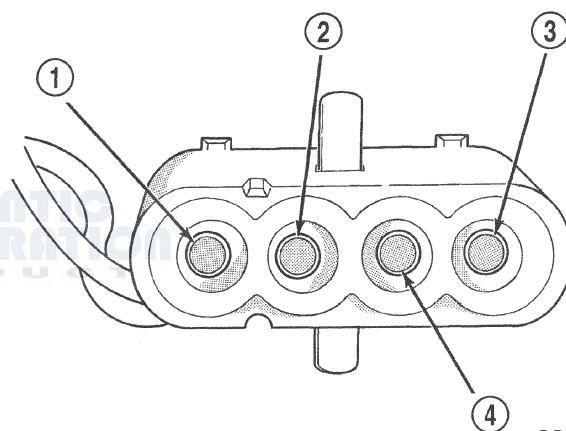
(3) While feeding wires into guide grooves, slide level sensor up into channel until it snaps into place (Fig. 23). Ensure tab at bottom of sensor locks in place.

(4) Install level sensor wires in connector. Push the wires up through the connector and then pull them down until they lock in place. Ensure signal and ground wires are installed in the correct position (Fig. 24).

(5) Install locking wedge on connector.

(6) Push connector up into bottom of fuel pump module electrical connector.

(7) Install fuel pump module. Refer to Fuel Pump Module in this section.



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**Fig. 24 Fuel/Pump/Level Sensor Electrical Connector**

- 1 - PUMP GROUND  
2 - LEVEL SENSOR GROUND  
3 - FUEL PUMP SUPPLY  
4 - LEVEL SENSOR SIGNAL

**FUEL RAIL—2.5L****REMOVAL**

**WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.**

(1) Release fuel system pressure. Refer to Fuel System Pressure Release procedure in this section.

(2) Disconnect negative cable from auxiliary jumper terminal.

**REMOVAL AND INSTALLATION (Continued)**

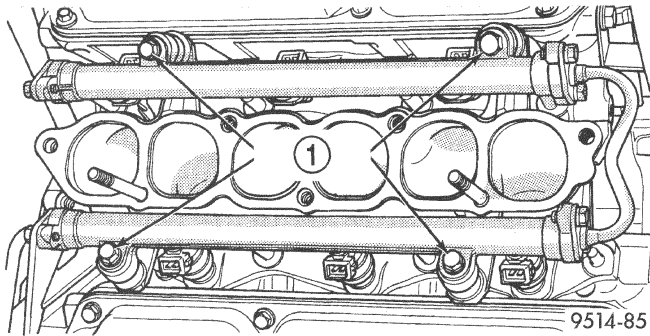
**WARNING: WRAP SHOP TOWELS AROUND HOSE TO CATCH ANY GASOLINE SPILLAGE.**

(3) Disconnect fuel supply tube from rail. Refer to Quick-Connect Fittings in this section.

(4) Remove the Intake Manifold, refer to the Engine section.

(5) Disconnect electrical connectors from fuel injectors.

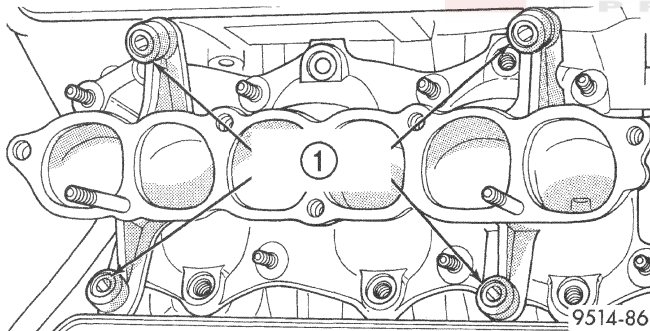
(6) Remove 4 bolts holding fuel rail (Fig. 25).



**Fig. 25 Fuel Rail Attachment**

1 - FUEL RAIL BOLTS

(7) Lift fuel rail off engine. **There are spacers under each fuel rail bolt (Fig. 26).**



**Fig. 26 Fuel Rail Spacers**

1 - FUEL RAIL SPACERS

**INSTALLATION**

(1) Apply a light coating of clean engine oil to the O-ring on the nozzle end of each injector.

**CAUTION: Make sure spacers are located under each fuel rail mounting position.**

(2) Insert fuel injector nozzles into openings in intake manifold. Seat the injectors in place. Tighten fuel rail bolts to 12 N·m (8 ft. lbs.).

(3) Attach electrical connectors to fuel injectors.

(4) Connect fuel supply tube to fuel rail. Refer to Quick Connect Fittings in the Fuel Delivery section

(5) Install Intake Manifold, refer to the Engine section.

(6) Install throttle cables.

(7) Attach electrical connectors to sensors.

(8) Tighten air inlet tube clamps to 3 N·m ±1 (25 in. lbs. ±5) torque.

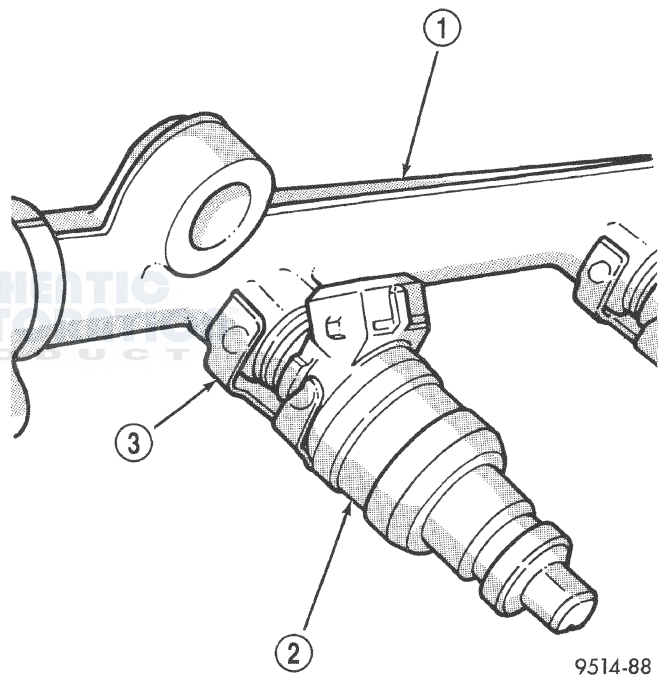
(9) Connect negative terminal to auxiliary jumper terminal.

**FUEL INJECTORS****REMOVAL**

(1) Remove the negative battery cable.

(2) Remove fuel rail. Refer to appropriate Fuel Rail Removal in this section.

(3) Remove fuel injector (Fig. 27).



**Fig. 27 Fuel Injector Clip—2.5L Engine**

1 - FUEL RAIL

2 - FUEL INJECTOR

3 - INJECTOR CLIP

(4) Pull injector out of fuel rail. Replace fuel injector O-rings.

**INSTALLATION**

(1) Install injector to fuel rail.

(2) Install fuel injector clip.

(3) Install fuel rail refer to the Fuel Rail installation in this section.

(4) Install the negative battery cable.

(5) Use the DRB scan tool ASD Fuel system test to pressurize the the fuel system. Check for leaks.



## REMOVAL AND INSTALLATION (Continued)

### FUEL TANK

**WARNING: RELEASE FUEL SYSTEM PRESSURE BEFORE SERVICING FUEL SYSTEM COMPONENTS. SERVICE VEHICLES IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. NEVER SMOKE WHILE SERVICING THE VEHICLE.**

### REMOVAL

(1) Release fuel system pressure. Refer to Fuel Pressure Release Procedure in this section.

(2) Disconnect negative cable from auxiliary jumper terminal.

(3) From inside trunk, disconnect pump wiring jumper from main body harness. The 4 pin connector is located under the trunk mat on the left side of trunk near the base of the shock tower. Locate body grommet for jumper near base of rear seat. Push grommet out and feed jumper completely through hole in body.

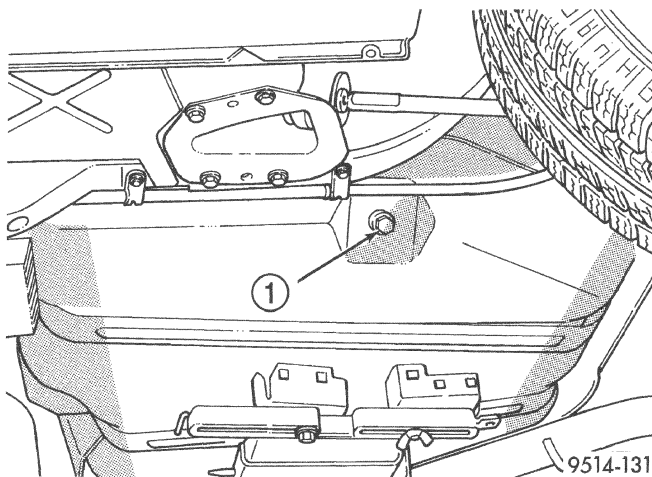
(4) Remove fuel cap slowly to release tank pressure.

(5) With vehicle on a hoist, drain fuel from tank. Support fuel tank with a support such as a transmission jack stand.

(6) Position a fuel approved container, with a capacity of at least 16 gallons, under the drain plug located on the bottom left edge of the tank.

**CAUTION: Use a backup wrench on tank to remove drain plug.**

(7) Remove drain plug and allow fuel to drain (Fig. 28).



**Fig. 28 Fuel Tank Drain Plug**

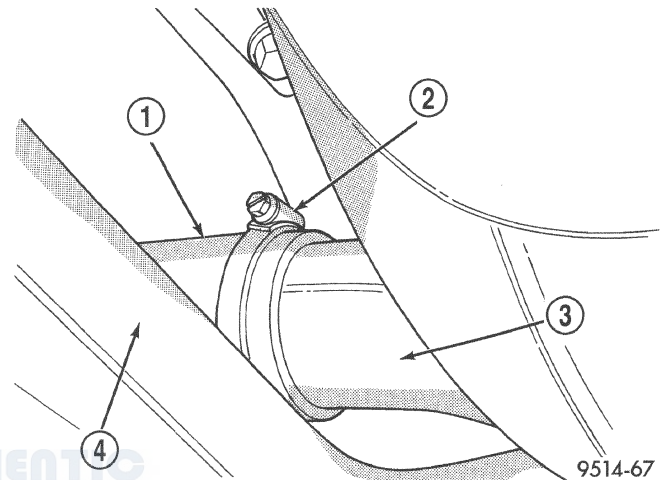
1 - FUEL TANK DRAIN PLUG

**WARNING: DRAIN PLUG MUST BE INSTALLED AT THIS TIME AS THERE WILL BE 1 TO 2 GALLONS OF FUEL LEFT IN THE TANK.**

(8) When tank is no longer draining, install drain plug. Tighten plug to 32 in. lbs.

**WARNING: There may be fuel in the fill tube. Remove hose carefully to reduce fuel splash.**

(9) Disconnect fuel tank from rubber fill hose (Fig. 29).



**Fig. 29 Fuel Filler Hose Clamp**

1 - FUEL FILLER HOSE  
2 - HOSE CLAMP  
3 - FUEL TANK INLET  
4 - REAR CROSS MEMBER

**WARNING: WRAP SHOP TOWELS AROUND HOSES TO CATCH ANY GASOLINE SPILLAGE.**

(10) Disconnect fuel lines from fuel pump module. These are quick connect fittings (Fig. 30).

(11) Disconnect recirculation line from tee on tank mounted rollover valve. The valve is located at the rear of the tank and connects to the vapor line with a rubber hose.

(12) Remove bolts and fuel tank straps.

(13) Remove vacuum line to LDP.

(14) Remove tank from vehicle. Slide tank forward during removal to allow fill neck to clear suspension cross-member.

### INSTALLATION

(1) Position fuel tank on transmission jack.

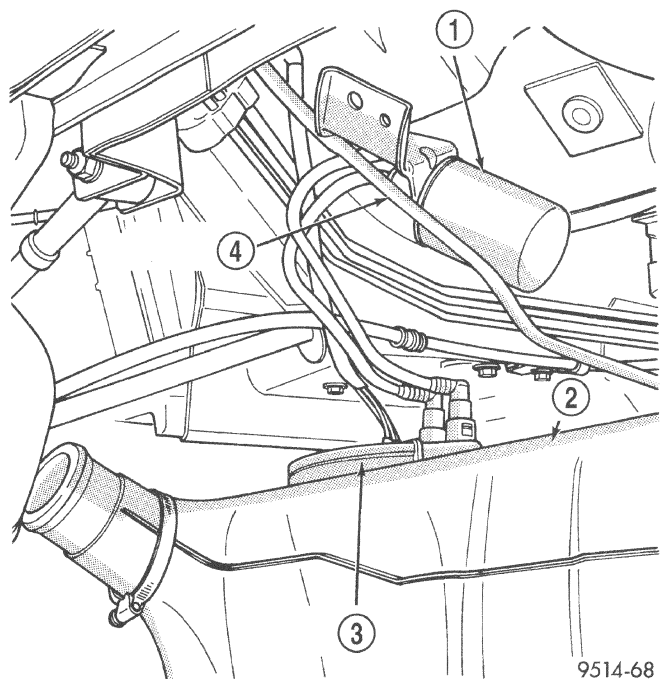
(2) Raise tank into position.

(3) Connect vapor line to tee to rollover valve.

(4) Install EVAP hoses and lines.

(5) Connect chassis fuel tube to fuel filter. Refer to Quick Connect Fittings in the Fuel Delivery section of this Group.



**REMOVAL AND INSTALLATION (Continued)****Fig. 30 Fuel Tank Removal**

- 1 - FUEL FILTER
- 2 - FUEL TANK
- 3 - FUEL PUMP MODULE
- 4 - FUEL TANK VAPOR LINE

(6) Connect fuel fill tube to tank inlet. Tighten hose clamp to 3.5 N·m (31 in. lbs.) torque.

(7) Install pump module harness grommet into body.

(8) Position fuel filter and fuel tank straps. Install the front bolts first and then the rear bolts. Tighten fuel tank strap bolts to 23 N·m (250 in. lbs.) torque. Remove transmission jack. Ensure straps are not twisted or bent.

(9) Lower vehicle.

(10) Connect fuel pump module connector.

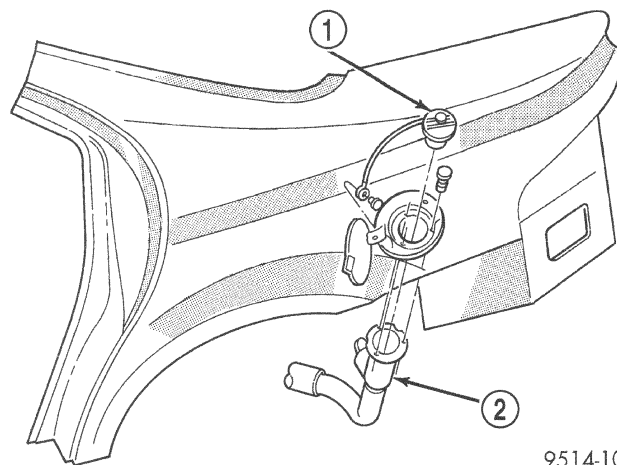
(11) Fill fuel tank, install filler cap, and connect battery cable.

**CAUTION:** When using the ASD Fuel System Test, the ASD relay remains energized for either 7 minutes, until the test is stopped, or until the ignition switch is turned to the Off position.

(12) Use the DRB scan tool ASD Fuel System Test to pressurize the fuel system. Check for leaks.

**FUEL FILLER NECK****REMOVAL**

- (1) Loosen fuel filler tube cap.
- (2) Remove fuel filler neck screws (Fig. 31).
- (3) Disconnect Ground strap from body.



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**Fig. 31 Fuel Filler Neck Removal/Installation**

- 1 - FILLER CAP
- 2 - FILLER NECK

(4) Disconnect fuel filler tube hose from fuel tank neck. Remove fuel filler tube assembly.

**INSTALLATION**

(1) Install fuel filler tube. Connect fuel filler tube hose to fuel tank neck.

(2) Install fuel filler neck screws (Fig. 31).

(3) Install fuel filler tube cap.

**ACCELERATOR PEDAL****REMOVAL**

(1) Remove the throttle cable from the throttle body cam as described in Throttle Cable of this section.

(2) Reach behind the top of the pedal shaft and push the retainer toward rear of vehicle (Fig. 32). It may be necessary to squeeze retainer ears together on dash side of pedal shaft.

(3) Lift cable up through slot in top of pedal shaft.

(4) Remove nuts from accelerator pedal assembly studs. Remove assembly from vehicle.

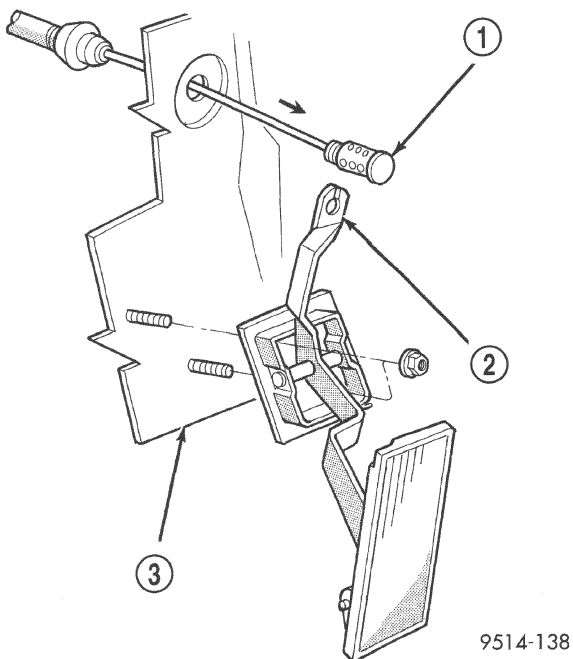
**INSTALLATION**

(1) Position accelerator pedal assembly on dash panel. Install retaining nuts. Tighten retaining nuts to 12 N·m (105 in. lbs.) torque.

(2) Place cable through slot in top of pedal shaft.

(3) While holding pedal lever, Push retainer clip forward in vehicle engaging it into the pedal lever.

(4) Hold the throttle body lever in the wide open position and install the throttle cable.

**REMOVAL AND INSTALLATION (Continued)****Fig. 32 Accelerator Pedal and Throttle Cable**

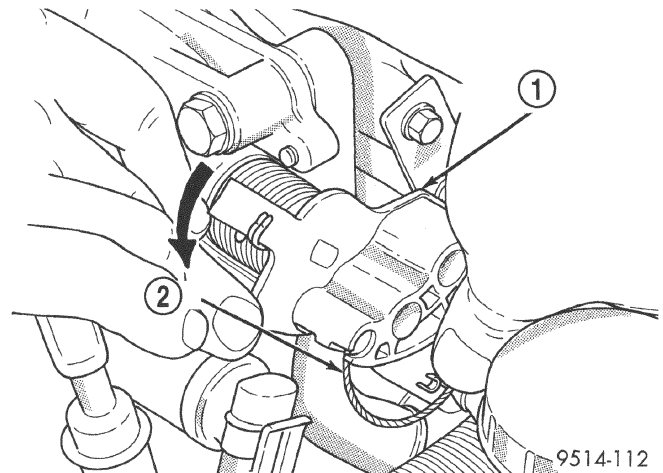
- 1 - CABLE
- 2 - PEDAL SHAFT
- 3 - DASH PANEL

**THROTTLE CABLE—2.5L****REMOVAL**

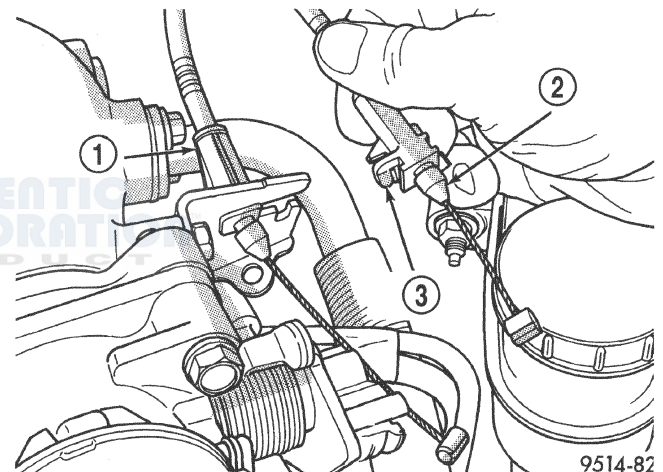
- (1) Working from the engine compartment, remove throttle cable from the throttle body lever (Fig. 33).
- (2) Push release tang toward dash panel on throttle cable and slide cable out of bracket (Fig. 34).
- (3) From inside the vehicle, reach behind the top of the pedal shaft and push the retainer toward rear of vehicle. It may be necessary to squeeze retainer ears together on dash side of pedal shaft.
- (4) Lift cable up through slot in top of pedal shaft.
- (5) Remove throttle cable clip attached at grommet in front of dash panel.
- (6) From the engine compartment, pull the throttle cable and grommet out of the dash panel.

**INSTALLATION**

- (1) From the engine compartment, push the cable end fitting and grommet into the dash panel.
- (2) Install throttle cable clip.

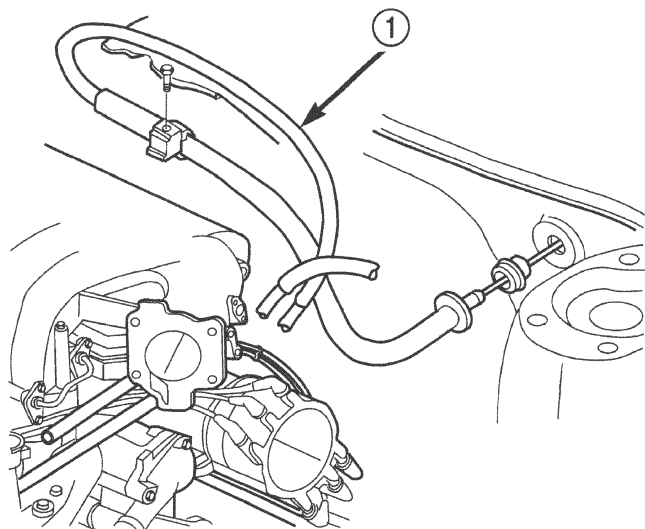
**Fig. 33 Throttle Cable Attachment to Throttle Body**

- 1 - THROTTLE LEVER
- 2 - THROTTLE CABLE

**Fig. 34 Throttle Cable Attachment**

- 1 - SPEED CONTROL CABLE
- 2 - THROTTLE CABLE
- 3 - RELEASE TANG

- (3) Install cable housing (throttle body end) into the cable mounting bracket on the engine.
- (4) Place cable through slot in top of pedal shaft.
- (5) While holding the pedal lever, push retainer clip forward in vehicle engaging it into the pedal lever.
- (6) From the engine compartment, rotate the throttle lever forward to the wide open position and install cable clasp.

**REMOVAL AND INSTALLATION (Continued)****Fig. 35 Cable Routing 2.5L**

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1 - THROTTLE CABLE

**SPECIFICATIONS****TORQUE****DESCRIPTION****TORQUE**

Accelerator Pedal to Dash Nuts . . . . .	12 N·m (105 in. lbs.)
Fuel Filter Mounting Screw . . . . .	12 N·m (110 in. lbs.)
Fuel Pump Module Locknut . . . . .	74.5 N·m (55 ft. lbs.)
Fuel Tank strap Bolts . . . . .	28.2 N·m (250 in. lbs.)
Fuel Rail Bolts—2.0/2.4L . . . . .	22.5 N·m (200 in. lbs.)
Fuel Rail Bolts—2.5L . . . . .	12 N·m (106 in. lbs.)
Ignition Coil Mounting Bolts . . . . .	12 N·m (105 in. lbs.)

**FUEL TANK CAPACITY**

Vehicle	Liters	U. S. Gallons
JX	60	16
Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.		



**AUTHENTIC  
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PRODUCT**



# FUEL INJECTION SYSTEM

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## DESCRIPTION AND OPERATION

### INJECTION SYSTEM

#### OPERATION

All engines used in this section have a sequential Multi-Port Electronic Fuel Injection system. The MPI system is computer regulated and provides precise air/fuel ratios for all driving conditions. The Powertrain Control Module (PCM) operates the fuel injection system.

The PCM regulates:

- Ignition timing
- Air/fuel ratio
- Emission control devices
- Cooling fan
- Charging system

- Idle speed
- Vehicle speed control

Various sensors provide the inputs necessary for the PCM to correctly operate these systems. In addition to the sensors, various switches also provide inputs to the PCM.

The PCM can adapt its programming to meet changing operating conditions.

Fuel is injected into the intake port above the intake valve in precise metered amounts through electrically operated injectors. The PCM fires the injectors in a specific sequence. Under most operating conditions, the PCM maintains an air fuel ratio of 14.7 parts air to 1 part fuel by constantly adjusting injector pulse width. Injector pulse width is the length of time the injector is open.

The PCM adjusts injector pulse width by opening and closing the ground path to the injector. Engine



## DESCRIPTION AND OPERATION (Continued)

RPM (speed) and manifold absolute pressure (air density) are the primary inputs that determine injector pulse width.

### PCM REPLACEMENT

#### DESCRIPTION

**USE THE DRB SCAN TOOL TO REPROGRAM THE NEW PCM WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE VEHICLES ORIGINAL MILEAGE. IF THIS STEP IS NOT DONE A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.**

### MODES OF OPERATION

#### OPERATION

As input signals to the PCM change, the PCM adjusts its response to output devices. For example, the PCM must calculate a different injector pulse width and ignition timing for idle than it does for Wide Open Throttle (WOT). There are several different modes of operation that determine how the PCM responds to the various input signals.

There are two different areas of operation, OPEN LOOP and CLOSED LOOP.

During OPEN LOOP modes the PCM receives input signals and responds according to preset PCM programming. Inputs from the upstream and downstream heated oxygen sensors are not monitored during OPEN LOOP modes, except for heated oxygen sensor diagnostics (they are checked for shorted conditions at all times).

During CLOSED LOOP modes the PCM monitors the inputs from the upstream and downstream heated oxygen sensors. The upstream heated oxygen sensor input tells the PCM if the calculated injector pulse width resulted in the ideal air-fuel ratio of 14.7 to one. By monitoring the exhaust oxygen content through the upstream heated oxygen sensor, the PCM can fine tune injector pulse width. Fine tuning injector pulse width allows the PCM to achieve optimum fuel economy combined with low emissions.

For the PCM to enter CLOSED LOOP operation, the following must occur:

- (1) Engine coolant temperature must be over 35°F.
  - If the coolant is over 35° the PCM will wait 44 seconds.
  - If the coolant is over 50°F the PCM will wait 38 seconds.
  - If the coolant is over 167°F the PCM will wait 11 seconds.
- (2) For other temperatures the PCM will interpolate the correct waiting time.
- (3) O2 sensor must read either greater than 0.745 volts or less than 0.1 volt.

(4) The multi-port fuel injection systems has the following modes of operation:

- Ignition switch ON (Zero RPM)
- Engine start-up
- Engine warm-up
- Cruise
- Idle
- Acceleration
- Deceleration
- Wide Open Throttle
- Ignition switch OFF

(5) The engine start-up (crank), engine warm-up, deceleration with fuel shutoff and wide open throttle modes are OPEN LOOP modes. Under most operating conditions, the acceleration, deceleration (with A/C on), idle and cruise modes, **with the engine at operating temperature** are CLOSED LOOP modes.

#### IGNITION SWITCH ON (ZERO RPM) MODE

When the ignition switch activates the fuel injection system, the following actions occur:

- The PCM monitors the engine coolant temperature sensor and throttle position sensor input. The PCM determines basic fuel injector pulse width from this input.
- The PCM determines atmospheric air pressure from the MAP sensor input to modify injector pulse width.

When the key is in the ON position and the engine is not running (zero rpm), the Auto Shutdown (ASD) and fuel pump relays de-energize after approximately 1 second. Therefore, battery voltage is not supplied to the fuel pump, ignition coil, fuel injectors and heated oxygen sensors.

#### ENGINE START-UP MODE

This is an OPEN LOOP mode. If the vehicle is in park or neutral (automatic transaxles) or the clutch pedal is depressed (manual transaxles) the ignition switch energizes the starter relay. The following actions occur when the starter motor is engaged.

- If the PCM receives the camshaft position sensor and crankshaft position sensor signals, it energizes the Auto Shutdown (ASD) relay and fuel pump relay. If the PCM does not receive both signals within approximately one second, it will not energize the ASD relay and fuel pump relay. The ASD and fuel pump relays supply battery voltage to the fuel pump, fuel injectors, ignition coil and heated oxygen sensors.
- The PCM energizes the injectors (on the 69° degree falling edge) for a calculated pulse width until it determines crankshaft position from the camshaft position sensor and crankshaft position sensor signals. The PCM determines crankshaft position within 1 engine revolution.

## DESCRIPTION AND OPERATION (Continued)

- After determining crankshaft position, the PCM begins energizing the injectors in sequence. It adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

- When the engine idles within  $\pm 64$  RPM of its target RPM, the PCM compares current MAP sensor value with the atmospheric pressure value received during the Ignition Switch On (zero RPM) mode.

Once the ASD and fuel pump relays have been energized, the PCM determines injector pulse width based on the following:

- Battery voltage
- Engine coolant temperature
- Engine RPM
- Inlet/Intake air temperature (IAT)
- MAP
- Throttle position
- The number of engine revolutions since cranking was initiated

During Start-up the PCM maintains ignition timing at 9° BTDC.

### ENGINE WARM-UP MODE

This is an OPEN LOOP mode. The following inputs are received by the PCM:

- Engine coolant temperature
- Manifold Absolute Pressure (MAP)
- Inlet/Intake air temperature (IAT)
- Crankshaft position (engine speed)
- Camshaft position
- Knock sensor
- Throttle position
- A/C switch
- Battery voltage
- Power steering pressure switch
- Vehicle speed
- Speed control
- O<sub>2</sub> sensors

The PCM adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

The PCM adjusts ignition timing and engine idle speed. Engine idle speed is adjusted through the idle air control motor.

### CRUISE OR IDLE MODE

When the engine is at operating temperature this is a CLOSED LOOP mode. During cruising or idle the following inputs are received by the PCM:

- Inlet/Intake air temperature
- Engine coolant temperature
- Manifold absolute pressure
- Crankshaft position (engine speed)
- Camshaft position
- Knock sensor

- Throttle position
- Exhaust gas oxygen content
- A/C control positions
- Power steering pressure switch
- Battery voltage
- Vehicle speed

The PCM adjusts injector pulse width and controls injector synchronization by turning the individual ground paths to the injectors On and Off.

The PCM adjusts engine idle speed and ignition timing. The PCM adjusts the air/fuel ratio according to the oxygen content in the exhaust gas (measured by the upstream and downstream heated oxygen sensor).

The PCM monitors for engine misfire. During active misfire and depending on the severity, the PCM either continuously illuminates or flashes the malfunction indicator lamp (Check Engine light on instrument panel). Also, the PCM stores an engine misfire DTC in memory.

The PCM performs several diagnostic routines. They include:

- Oxygen sensor monitor
- Downstream heated oxygen sensor diagnostics during open loop operation (except for shorted)
- Fuel system monitor
- EGR monitor
- Purge system monitor
- All inputs monitored for proper voltage range.
- All monitored components (refer to the Emission section for On-Board Diagnostics).

The PCM compares the upstream and downstream heated oxygen sensor inputs to measure catalytic converter efficiency. If the catalyst efficiency drops below the minimum acceptable percentage, the PCM stores a diagnostic trouble code in memory.

During certain idle conditions, the PCM may enter a variable idle speed strategy. During variable idle speed strategy the PCM adjusts engine speed based on the following inputs.

- A/C sense
- Battery voltage
- Battery temperature
- Engine coolant temperature
- Engine run time
- Inlet/Intake air temperature
- Power steering pressure switch
- Vehicle mileage

### ACCELERATION MODE

This is a CLOSED LOOP mode. The PCM recognizes an abrupt increase in Throttle Position sensor output voltage or MAP sensor output voltage as a demand for increased engine output and vehicle acceleration. The PCM increases injector pulse width in response to increased fuel demand.



**DESCRIPTION AND OPERATION (Continued)****DECELERATION MODE**

This is a CLOSED LOOP mode. During deceleration the following inputs are received by the PCM:

- A/C sense
- Battery voltage
- Inlet/Intake air temperature
- Engine coolant temperature
- Crankshaft position (engine speed)
- Exhaust gas oxygen content (upstream heated oxygen sensor)
- Knock sensor
- Manifold absolute pressure
- Power steering pressure switch
- Throttle position
- IAC motor control changes in response to MAP sensor feedback

The PCM may receive a closed throttle input from the Throttle Position Sensor (TPS) when it senses an abrupt decrease in manifold pressure. This indicates a hard deceleration. In response, the PCM may momentarily turn off the injectors. This helps improve fuel economy, emissions and engine braking.

**WIDE-OPEN-THROTTLE MODE**

This is an OPEN LOOP mode. During wide-open-throttle operation, the following inputs are used by the PCM:

- Inlet/Intake air temperature
- Engine coolant temperature
- Engine speed
- Knock sensor
- Manifold absolute pressure
- Throttle position

When the PCM senses a wide-open-throttle condition through the Throttle Position Sensor (TPS) it de-energizes the A/C compressor clutch relay. This disables the air conditioning system.

The PCM does not monitor the heated oxygen sensor inputs during wide-open-throttle operation except for downstream heated oxygen sensor and both shorted diagnostics. The PCM adjusts injector pulse width to supply a predetermined amount of additional fuel.

**IGNITION SWITCH OFF MODE**

When the operator turns the ignition switch to the OFF position, the following occurs:

- All outputs are turned off, unless 02 Heater Monitor test is being run. Refer to the Emission section for On-Board Diagnostics.
- No inputs are monitored except for the heated oxygen sensors. The PCM monitors the heating elements in the oxygen sensors and then shuts down.

**SYSTEM DIAGNOSIS****OPERATION**

The PCM can test many of its own input and output circuits. If the PCM senses a fault in a major system, the PCM stores a Diagnostic Trouble Code (DTC) in memory.

For DTC information see On-Board Diagnostics.

**CCD BUS****DESCRIPTION**

Various controllers and modules exchange information through a two-wire communication port called the CCD Bus. The PCM transmits various monitored input information and control requests to other modules on the CCD Bus. The PCM also receives information and requests that effects the control of its outputs from other controllers over the CCD Bus. The CCD Bus has a measurable voltage of approximately 2.5 volts.

**OPERATION**

Various modules exchange information through a communications port called the CCD Bus. The Powertrain Control Module (PCM) transmits the Malfunction Indicator Lamp (Check Engine) On/Off signal and engine RPM on the CCD Bus. The PCM receives the Air Conditioning select input, transaxle gear position input and speed control engage inputs over the CCD Bus. The PCM also receives the air conditioning evaporator temperature signal from the CCD Bus.

The following components access or send information on the CCD Bus.

- Instrument Panel
- Body Control Module
- Air Bag System Diagnostic Module
- Full ATC Display Head
- ABS Module
- Transmission Control Module
- Powertrain Control Module
- Travel Module (if equipped)

**POWERTRAIN CONTROL MODULE****OPERATION**

The Powertrain Control Module (PCM) is a digital computer containing a microprocessor. The PCM receives input signals from various switches and sensors that are referred to as PCM Inputs. Based on these inputs, the PCM adjusts various engine and vehicle operations through devices that are referred to as PCM Outputs.

**DESCRIPTION AND OPERATION (Continued)****NOTE: PCM Inputs:**

- Air Conditioning Controls
- Battery Voltage
- Battery Temperature Sensor
- Brake Switch
- Camshaft Position Sensor
- Crankshaft Position Sensor
- CCD Bus
- Engine Coolant Temperature Sensor
- Fuel Level Sensor
- Ignition Switch
- Intake Air Temperature Sensor
- Knock Sensor (2.0/2.4L only)
- Leak Detection Pump
- Manifold Absolute Pressure (MAP) Sensor
- Oxygen Sensors
- Power Steering Pressure Switch
- SCI Receive
- Speed Control Switches
- Throttle Position Sensor
- Transmission Park/Neutral Switch (automatic transmission)
  - Vehicle Speed Sensor

**NOTE: PCM Outputs:**

- Air Conditioning Clutch Relay
- Auto Shutdown (ASD) Relay
- Charging Indicator Lamp
- CCD Bus
- SCI Transmit
- Proportional Purge Solenoid
- EGR Solenoid
- Fuel Injectors
- Fuel Pump Relay
- Generator Field
- Idle Air Control Motor
- Ignition Coils
- Malfunction Indicator (Check Engine) Lamp
- Radiator Fan Relays
- Speed Control Solenoids

Based on inputs it receives, the PCM adjusts fuel injector pulse width, idle speed, ignition spark advance, ignition coil dwell and EVAP canister purge operation. The PCM regulates the cooling fan, air conditioning and speed control systems. The PCM changes generator charge rate by adjusting the generator field. The PCM also performs diagnostics.

The PCM adjusts injector pulse width (air-fuel ratio) based on the following inputs.

- Battery voltage
- Coolant temperature
- Exhaust gas content (oxygen sensor)
- Engine speed (crankshaft position sensor)
- Intake air temperature
- Manifold absolute pressure

- Throttle position

The PCM adjusts ignition timing based on the following inputs.

- Coolant temperature
- Engine speed (crankshaft position sensor)
- Knock sensor
- Manifold absolute pressure
- Throttle position
- Transmission gear selection (park/neutral switch)

- Intake air temperature

The PCM also adjusts engine idle speed through the idle air control motor based on the following inputs.

- Air conditioning sense
- Battery voltage
- Battery temperature
- Brake switch
- Coolant temperature
- Engine speed (crankshaft position sensor)
- Engine run time
- Manifold absolute pressure
- Power steering pressure switch
- Throttle position
- Transmission gear selection (park/neutral switch)

- Vehicle distance (speed)

The Auto Shutdown (ASD) and fuel pump relays are located in the Power Distribution Center (PDC).

The camshaft position sensor (distributor pick-up signal 2.5L) and crankshaft position sensor signals are sent to the PCM. If the PCM does not receive the signal within approximately 1 second of engine cranking, it deactivates the ASD relay and fuel pump relay. When these relays are deactivated, power is shut off from the fuel injectors, ignition coils, oxygen sensor heating elements and fuel pump.

The PCM contains a voltage converter that changes battery voltage to a regulated 9 volts direct current to power the camshaft position sensor, crankshaft position sensor and vehicle speed sensor. The PCM also provides a 5 volt direct current supply for the manifold absolute pressure sensor, throttle position sensor, and A/C pressure switch.

**AUTOMATIC SHUTDOWN (ASD) SENSE—PCM INPUT****DESCRIPTION**

It is an input to the Powertrain Control Module from the relay in the Power Distribution Center, refer to the cover for relay location.

**OPERATION**

The ASD sense circuit informs the PCM when the ASD relay energizes. A 12 volt signal at this input



## DESCRIPTION AND OPERATION (Continued)

indicates to the PCM that the ASD has been activated. This input is used only to sense that the ASD relay is energized.

When energized, the ASD relay supplies battery voltage to the fuel injectors, ignition coils and the heating element in each oxygen sensor. If the PCM does not receive 12 volts from this input after grounding the ASD relay, it sets a Diagnostic Trouble Code (DTC).

When energized, the ASD relay provides power to operate the injectors, ignition coil, generator field, O2 sensor heaters (both upstream and downstream), and also provides a sense circuit to the PCM for diagnostic purposes. The PCM energizes the ASD any time there is a Crankshaft Position sensor signal that exceeds a predetermined value. The ASD relay can also be energized after the engine has been turned off to perform an O2 sensor heater test, if vehicle is equipped with OBD II diagnostics.

With SBEC III, the ASD relay's electromagnet is fed battery voltage, not ignition voltage. The PCM still provides the ground. As mentioned earlier, the PCM energizes the ASD relay during an O2 sensor heater test. This test is performed only after the engine has been shut off. The PCM still operates internally to perform several checks, including monitoring the O2 sensor heaters. This and other DTC tests are explained in detail in the On-Board Diagnostic Student Reference Book.

## BATTERY VOLTAGE—PCM INPUT

### DESCRIPTION

The direct battery feed to the PCM is used as a reference point to sense battery voltage.

### OPERATION

In order for the PCM to operate, it must be supplied with battery voltage and ground. The PCM monitors the direct battery feed input to determine battery charging rate and to control the injector initial opening point. It also has back-up RAM memory used to store Diagnostic Trouble Codes (supply working DTCs). Direct battery feed is also used to perform key-OFF diagnostics and to supply working voltage to the controller for OBDII.

If battery voltage is low the PCM will increase injector pulse width (period of time that the injector is energized).

### Effect on Fuel Injectors

Fuel injectors are rated for operation at a specific voltage. If the voltage increases, the plunger will open faster and conversely, if voltage is low the injector will be slow to open. Therefore, if sensed battery voltage drops, the PCM increases injector pulse-

width to maintain the same volume of fuel through the injector.

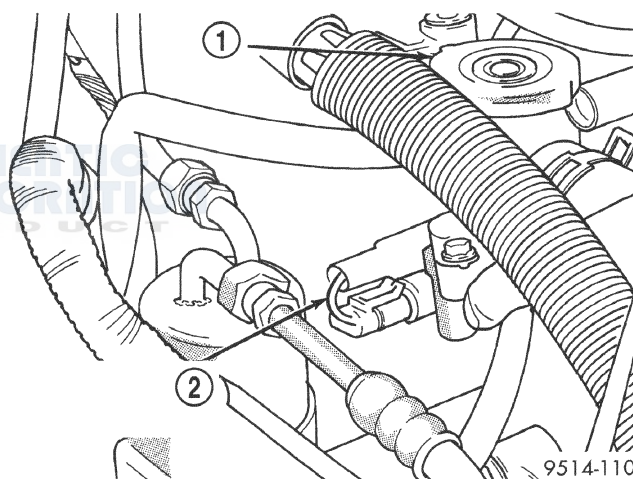
### Charging

The PCM uses sensed battery voltage to verify that target charging voltage (determined by Battery Temperature Sensor) is being reached. To maintain the target charging voltage, the PCM will full field the generator to 0.5 volt above target then turn OFF to 0.5 volt below target. This will continue to occur up to a 100 Hz frequency, 100 times per second.

## ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

### DESCRIPTION

The coolant sensor threads into the front of the cylinder head 2.4L (Fig. 1) ; next to the coolant fill neck 2.5L (Fig. 2). New sensors have sealant applied to the threads.



**Fig. 1 Engine Coolant Temperature Sensor—2.4L**

1 - COOLANT FILLER CAP

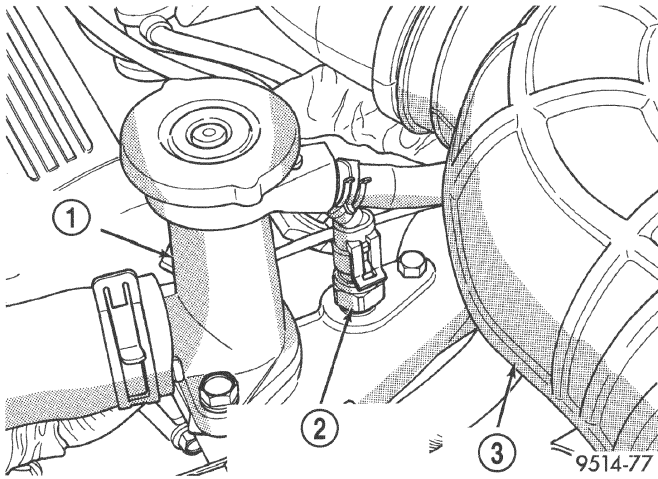
2 - ENGINE COOLANT TEMPERATURE SENDING UNIT

### OPERATION

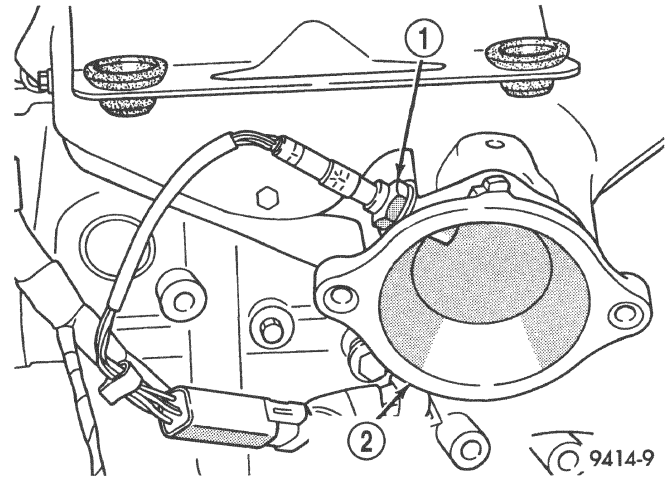
The coolant temperature sensor has one element. The element supplies coolant temperature signal to the PCM. The PCM supplies coolant temperature information on the CCD Bus to the Body Control Module (BCM) for the instrument panel gauge cluster. The PCM determines engine coolant temperature from the coolant temperature sensor.

As coolant temperature varies, the coolant temperature sensor resistance changes resulting in a different current draw from the PCM.

When the engine is cold, the PCM will provide slightly richer air-fuel mixtures and higher idle speeds until normal operating temperatures are reached.

**DESCRIPTION AND OPERATION (Continued)****Fig. 2 Engine Coolant Temperature Sensor—2.5L**

- 1 - COOLANT FILL NECK
- 2 - ENGINE COOLANT TEMPERATURE SENSOR
- 3 - AIR INLET TUBE

**Fig. 3 Oxygen Sensor 1/1 Upstream—2.0/2.4L Engines**

- 1 - OXYGEN SENSORS
- 2 - EXHAUST MANIFOLD

**FUEL LEVEL SENSOR—PCM INPUT****DESCRIPTION**

The fuel gauge level sending unit is attached to the fuel pump module.

**OPERATION**

The fuel level sensor (fuel gauge sending unit) sends a signal to the PCM to indicate fuel level. The purpose of this feature is to prevent a false setting of misfire and fuel system monitor trouble codes if the fuel level is less than approximately 15 percent of its rated capacity. It is also used to send a signal for fuel gauge operation via the PCI bus circuits.

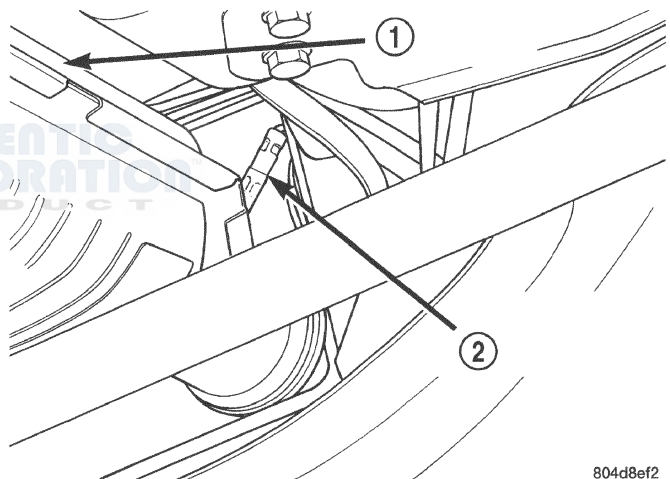
**HEATED OXYGEN SENSORS—PCM INPUT****DESCRIPTION**

The upstream oxygen sensor threads into the outlet flange of the exhaust manifold (Fig. 3) or (Fig. 4).

The downstream heated oxygen sensor threads into the outlet pipe at the rear of the catalytic converter (Fig. 5).

**OPERATION**

As vehicles accumulate mileage, the catalytic converter deteriorates. The deterioration results in a less efficient catalyst. To monitor catalytic converter deterioration, the fuel injection system uses two heated oxygen sensors. One sensor upstream of the catalytic converter, one downstream of the converter. The PCM compares the reading from the sensors to calculate the catalytic converter oxygen storage capacity and converter efficiency. Also, the PCM uses

**Fig. 4 Oxygen Sensor 1/1 Upstream—2.5L**

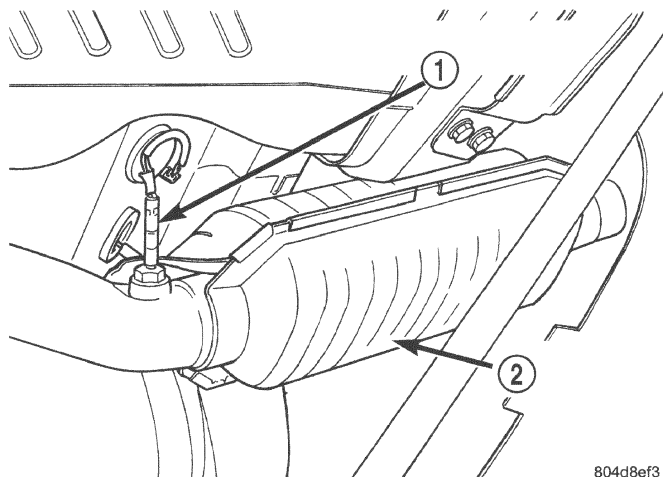
- 1 - CATALYTIC CONVERTOR
- 2 - UPSTREAM HEATED OXYGEN SENSOR

the upstream heated oxygen sensor input when adjusting injector pulse width.

When the catalytic converter efficiency drops below emission standards, the PCM stores a diagnostic trouble code and illuminates the malfunction indicator lamp (MIL).

The automatic shutdown relay supplies battery voltage to both the upstream and downstream heated oxygen sensors. The oxygen sensors are equipped with a heating element. The heating elements reduce the time required for the sensors to reach operating temperature.



**DESCRIPTION AND OPERATION (Continued)**

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**Fig. 5 Oxygen Sensor 1/2 Downstream**

- 1 - DOWNSTREAM HEATED OXYGEN SENSOR
- 2 - CATALYTIC CONVERTOR

**OXYGEN SENSOR 1/1 UPSTREAM**

The input from the upstream heated oxygen sensor tells the PCM the oxygen content of the exhaust gas. Based on this input, the PCM fine tunes the air-fuel ratio by adjusting injector pulse width.

The sensor input switches from 0 to 1 volt, depending upon the oxygen content of the exhaust gas in the exhaust manifold. When a large amount of oxygen is present (caused by a lean air-fuel mixture), the sensor produces voltage as low as 0.1 volt. When there is a lesser amount of oxygen present (rich air-fuel mixture) the sensor produces a voltage as high as 1.0 volt. By monitoring the oxygen content and converting it to electrical voltage, the sensor acts as a rich-lean switch.

The heating element in the sensor provides heat to the sensor ceramic element. Heating the sensor allows the system to enter into closed loop operation sooner. Also, it allows the system to remain in closed loop operation during periods of extended idle.

In Closed Loop, the PCM adjusts injector pulse width based on the upstream heated oxygen sensor input along with other inputs. In Open Loop, the PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

**OXYGEN SENSOR 1/2 DOWNSTREAM**

The downstream heated oxygen sensor input is used to detect catalytic convertor deterioration. As the convertor deteriorates, the input from the downstream sensor begins to match the upstream sensor input except for a slight time delay. By comparing the downstream heated oxygen sensor input to the input from the upstream sensor, the PCM calculates catalytic convertor efficiency.

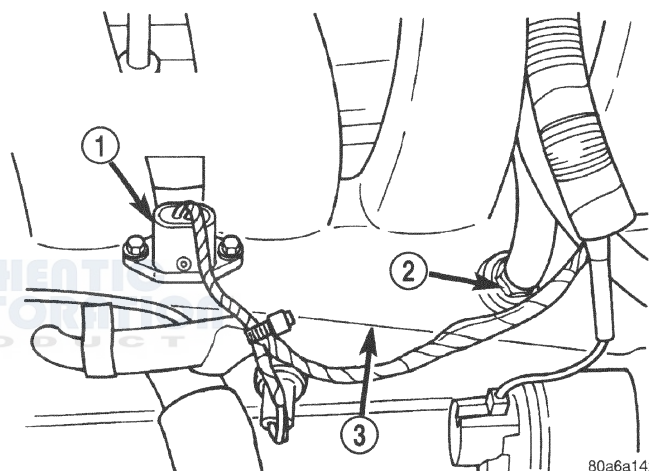
**IGNITION SENSE—PCM INPUT****OPERATION**

The ignition sense input informs the Powertrain Control Module (PCM) that the ignition switch is in the crank or run position.

**INTAKE AIR TEMPERATURE SENSOR—PCM INPUT****DESCRIPTION**

The IAT sensor and Manifold Absolute Pressure (MAP) sensor are a combined sensor that attach to the intake manifold (Fig. 6) for 2.0L engine.

The IAT sensor threads into the intake manifold (Fig. 7) or (Fig. 8) for the 2.4/2.5L engines.



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**Fig. 6 Intake Air Temperature Sensor and MAP Sensor—2.0L**

- 1 - MAP/AIR TEMPERATURE SENSOR
- 2 - PCV VACUUM NIPPLE
- 3 - INTAKE MANIFOLD

**OPERATION**

The Intake Air Temperature (IAT) sensor measures the temperature of the intake air as it enters the engine. The sensor supplies one of the inputs the PCM uses to determine injector pulse width and spark advance.

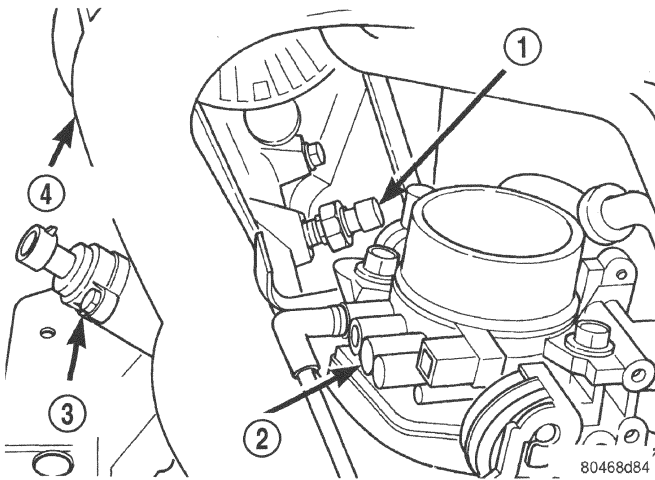
**MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT****DESCRIPTION**

The MAP sensor mounts to the intake manifold (Fig. 6), (Fig. 7), and (Fig. 8).

**OPERATION**

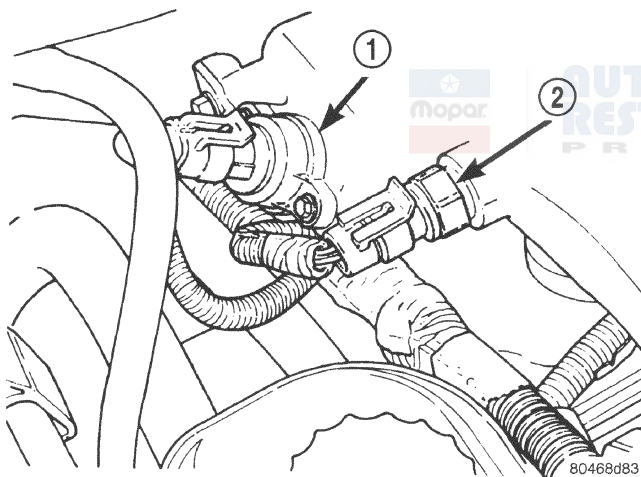
The MAP serves as a PCM input, using a silicon based sensing unit, to provide data on the manifold

## DESCRIPTION AND OPERATION (Continued)



**Fig. 7 Intake Air Temperature Sensor and MAP Sensor—2.4L**

- 1 - INTAKE AIR TEMPERATURE SENSOR
- 2 - THROTTLE BODY
- 3 - MAP SENSOR
- 4 - INTAKE MANIFOLD



**Fig. 8 Intake Air Temperature Sensor and MAP Sensor—2.5L**

- 1 - MAP SENSOR
- 2 - INTAKE AIR TEMPERATURE SENSOR

vacuum that draws the air/fuel mixture into the combustion chamber. The PCM requires this information to determine injector pulse width and spark advance. When MAP equals Barometric pressure, the pulse width will be at maximum.

Also like the cam and crank sensors, a 5 volt reference is supplied from the PCM and returns a voltage signal to the PCM that reflects manifold pressure. The zero pressure reading is 0.5V and full scale is 4.5V. For a pressure swing of 0 — 15 psi the voltage changes 4.0V. The sensor is supplied a regulated 4.8 to 5.1 volts to operate the sensor. Like the

cam and crank sensors ground is provided through the sensor return circuit.

The MAP sensor input is the number one contributor to pulse width. The most important function of the MAP sensor is to determine barometric pressure. The PCM needs to know if the vehicle is at sea level or is it in Denver at 5000 feet above sea level, because the air density changes with altitude. It will also help to correct for varying weather conditions. If a hurricane was coming through the pressure would be very, very low or there could be a real fair weather, high pressure area. This is important because as air pressure changes the barometric pressure changes. Barometric pressure and altitude have a direct inverse correlation, as altitude goes up barometric goes down. The first thing that happens as the key is rolled on, before reaching the crank position, the PCM powers up, comes around and looks at the MAP voltage, and based upon the voltage it sees, it knows the current barometric pressure relative to altitude. Once the engine starts, the PCM looks at the voltage again, continuously every 12 milliseconds, and compares the current voltage to what it was at key on. The difference between current and what it was at key on is manifold vacuum.

During key On (engine not running) the sensor reads (updates) barometric pressure. A normal range can be obtained by monitoring known good sensor in you work area.

As the altitude increases the air becomes thinner (less oxygen). If a vehicle is started and driven to a very different altitude than where it was at key On the barometric pressure needs to be updated. Any time the PCM sees Wide Open throttle, based upon TPS angle and RPM it will update barometric pressure in the MAP memory cell. With periodic updates, the PCM can make its calculations more effectively.

The PCM uses the MAP sensor to aid in calculating the following:

- Barometric pressure
- Engine load
- Manifold pressure
- Injector pulse-width
- Spark-advance programs
- Shift-point strategies (F4AC1 transmissions only, via the CCD bus)
- Idle speed
- Decel fuel shutoff

The MAP sensor signal is provided from a single piezoresistive element located in the center of a diaphragm. The element and diaphragm are both made of silicone. As the pressures changes the diaphragm moves causing the element to deflect which stresses the silicone. When silicone is exposed to stress its resistance changes. As manifold vacuum increases, the MAP sensor input voltage decreases proportionally. The sensor



## DESCRIPTION AND OPERATION (Continued)

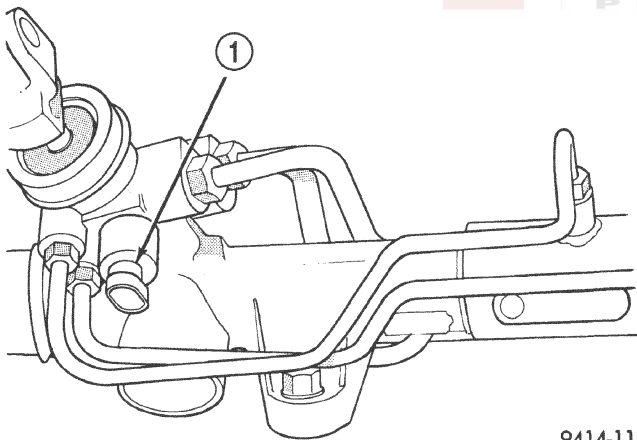
also contains electronics that condition the signal and provide temperature compensation.

The PCM recognizes a decrease in manifold pressure by monitoring a decrease in voltage from the reading stored in the barometric pressure memory cell. The MAP sensor is a linear sensor; as pressure changes, voltage changes proportionately. The range of voltage output from the sensor is usually between 4.6 volts at sea level to as low as 0.3 volts at 26 in. of Hg (Table 1). Barometric pressure is the pressure exerted by the atmosphere upon an object. At sea level on a standard day, no storm, barometric pressure is 29.92 in Hg. For every 100 feet of altitude barometric pressure drops .10 in. Hg. If a storm goes through it can either add, high pressure, or decrease, low pressure, from what should be present for that altitude. You should make a habit of knowing what the average pressure and corresponding barometric pressure is for your area. Always use the Diagnostic Test Procedures Manual for MAP sensor testing.

### POWER STEERING PRESSURE SWITCH—PCM INPUT

#### DESCRIPTION

A pressure sensing switch is located on the power steering gear.



9414-11

**Fig. 9 Power Steering Pressure Switch**

1 - POWER STEERING PRESSURE SWITCH

#### OPERATION

The switch (Fig. 9) provides an input to the PCM during periods of high pump load and low engine RPM; such as during parking maneuvers.

When power steering pump pressure exceeds 4137 kPa (600 psi), the switch is open. The PCM increases idle air flow through the IAC motor to prevent engine stalling. When pump pressure is low, the switch is closed.

### SENSOR RETURN—PCM INPUT

#### OPERATION

The sensor return circuit provides a low electrical noise ground reference for all of the systems sensors. The sensor return circuit connects to internal ground circuits within the Powertrain Control Module (PCM).

### SCI RECEIVE—PCM INPUT

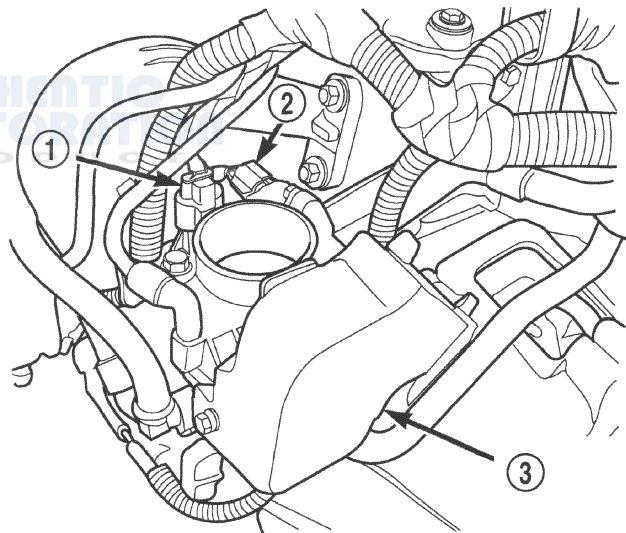
#### OPERATION

SCI Receive is the serial data communication receive circuit for the DRB scan tool. The Powertrain Control Module (PCM) receives data from the DRB through the SCI Receive circuit.

### THROTTLE POSITION SENSOR—PCM INPUT

#### DESCRIPTION

The throttle position sensor mounts to the side of the throttle body (Fig. 10) or (Fig. 11).



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**Fig. 10 Throttle Position Sensor—2.0/2.4L Engines**

1 - TPS

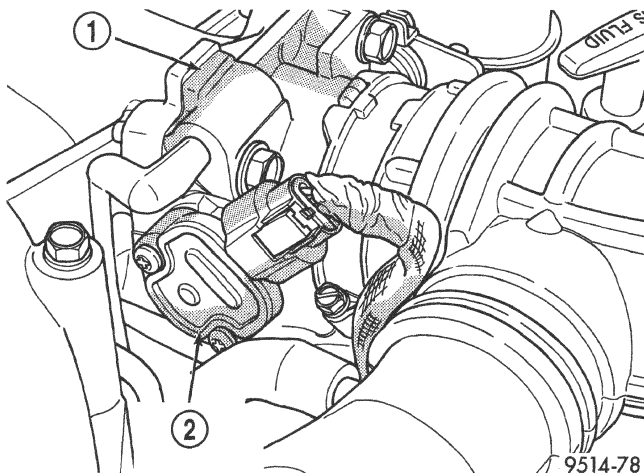
2 - IAC

3 - THROTTLE CONTROL SHIELD

#### OPERATION

The Throttle Position Sensor (TPS) connects to the throttle blade shaft. The TPS is a variable resistor that provides the PCM with an input signal (voltage). The signal represents throttle blade position. As the position of the throttle blade changes, the resistance of the TPS changes.

The PCM supplies approximately 5 volts DC to the TPS. The TPS output voltage (input signal to the PCM) represents throttle blade position. The TPS

**DESCRIPTION AND OPERATION (Continued)****Fig. 11 Throttle Position Sensor—2.5L Engine**

- 1 - THROTTLE BODY
- 2 - THROTTLE POSITION SENSOR

output voltage to the PCM varies from approximately 0.5 volt at minimum throttle opening (idle) to a maximum of 3.7 volts at wide open throttle.

Along with inputs from other sensors, the PCM uses TPS input to determine current engine operating conditions. The PCM also adjusts fuel injector pulse width and ignition timing based on these inputs.

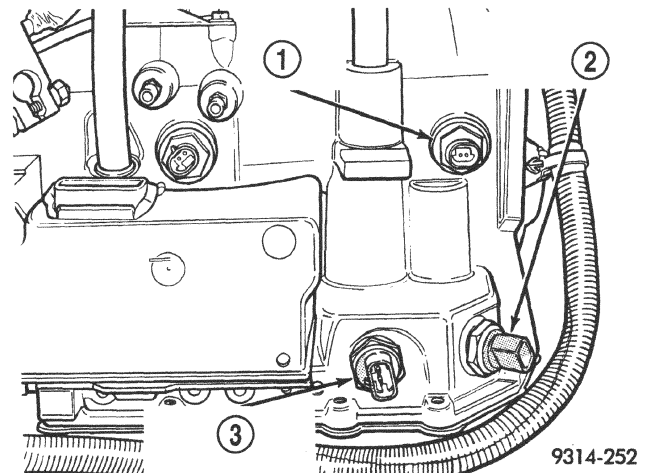
**VEHICLE SPEED AND DISTANCE—PCM INPUT****DESCRIPTION**

The vehicle speed output sensor is located in the transmission (Fig. 12).

**OPERATION**

The transaxle control module (TCM) supplies the vehicle speed signal to the PCM based on the output shaft speed. The PCM sends a 5 volt signal to the TCM. The TCM switches this signal to a ground, and then opens the circuit at a rate of 8000 pulses per mile. When the PCM counts 8000 pulses, the PCM assumes the vehicle has traveled one mile. The output speed sensor is located on the side of the transaxle (Fig. 12).

The speed and distance signals, along with a closed throttle signal from the TPS, determine if a closed throttle deceleration or normal idle condition (vehicle stopped) exists. Under deceleration conditions, the PCM adjusts the idle air control motor to maintain a desired MAP value. Under idle conditions, the PCM adjusts the idle air control motor to maintain a desired engine speed.

**Fig. 12 Output Speed Sensor— Automatic Transaxle**

- 1 - OUTPUT SPEED SENSOR
- 2 - PARK/NEUTRAL SWITCH (BLACK)
- 3 - TRANSMISSION RANGE SWITCH

**AUTOMATIC SHUTDOWN RELAY—PCM OUTPUT****DESCRIPTION**

The ASD relay and fuel pump relay are located in the Power Distribution Center (PDC) near the Air Cleaner (Fig. 13). The inside top of the PDC cover has a label showing relay and fuse location. They are ISO relays.

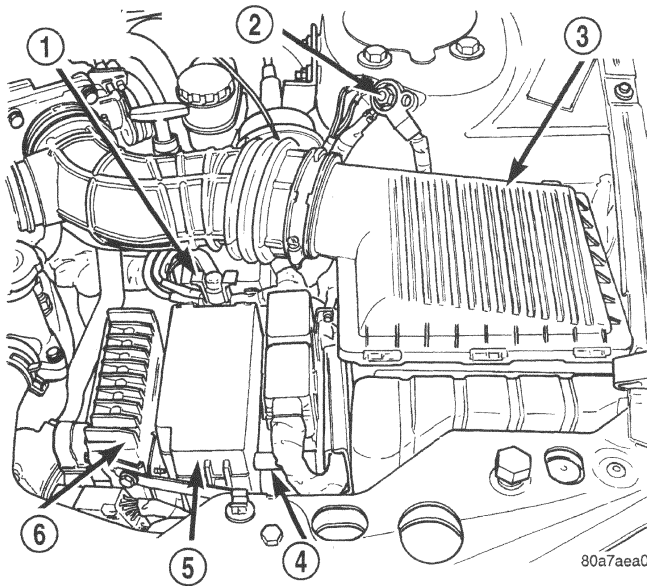
**OPERATION**

The PCM operates the Automatic Shut Down (ASD) relay and fuel pump relay through one ground path. The PCM operates them by switching the ground path for the relays on and off.

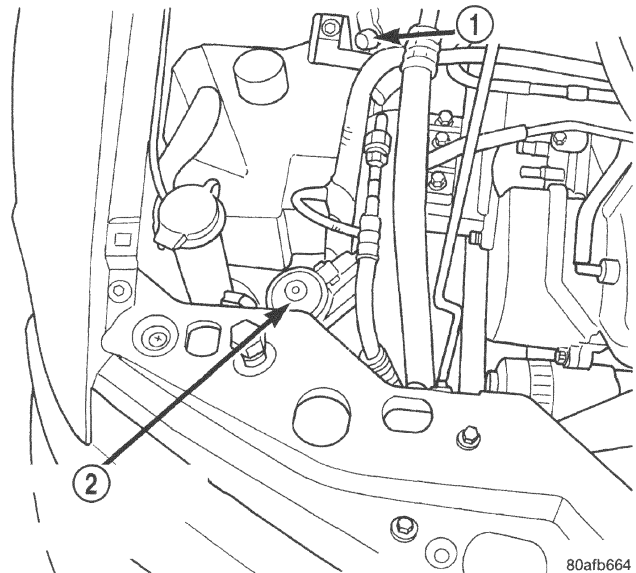
The ASD relay connects battery voltage to the fuel injectors and ignition coil. The fuel pump relay connects battery voltage to the fuel pump.

The PCM turns the ground path off when the ignition switch is in the Off position. Both relays are off. When the ignition switch is in the On or Crank position, the PCM monitors the crankshaft position sensor and camshaft position sensor signals to determine engine speed. If the PCM does not receive a crankshaft position sensor signal and camshaft position sensor signal when the ignition switch is in the Run position, it de-energizes both relays. When the relays are de-energized, battery voltage is not supplied to the fuel injectors, ignition coil and fuel pump.



**DESCRIPTION AND OPERATION (Continued)****Fig. 13 Power Distribution Center (PDC)**

- 1 - BATTERY POSITIVE
- 2 - BATTERY GROUND
- 3 - AIR CLEANER
- 4 - PCM
- 5 - PDC
- 6 - TCM

**Fig. 14 Proportional Purge Solenoid**

- 1 - TEST PORT
- 2 - PROPORTIONAL PURGE SOLENOID

**PROPORTIONAL PURGE SOLENOID—PCM OUTPUT****DESCRIPTION**

The solenoid attaches to a bracket near the front engine mount (Fig. 14). To operate correctly, the solenoid must be installed with the electrical connector on top.

**OPERATION**

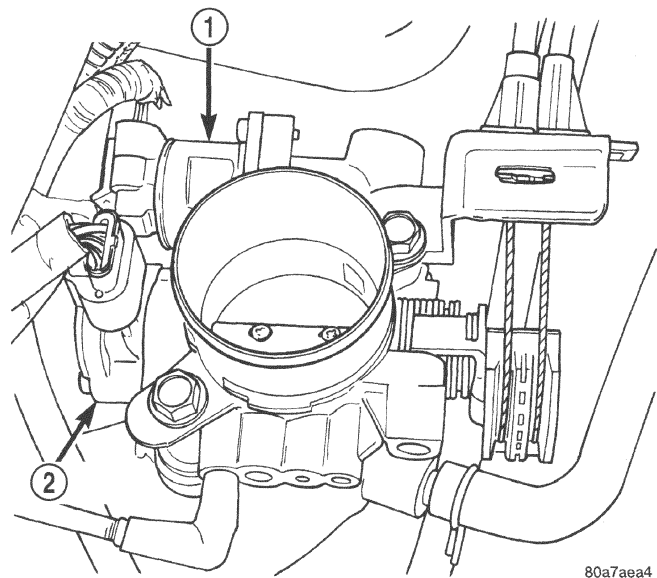
The purge solenoid regulates the rate of vapor flow from the EVAP canister to the throttle body. The PCM operates the solenoid.

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged.

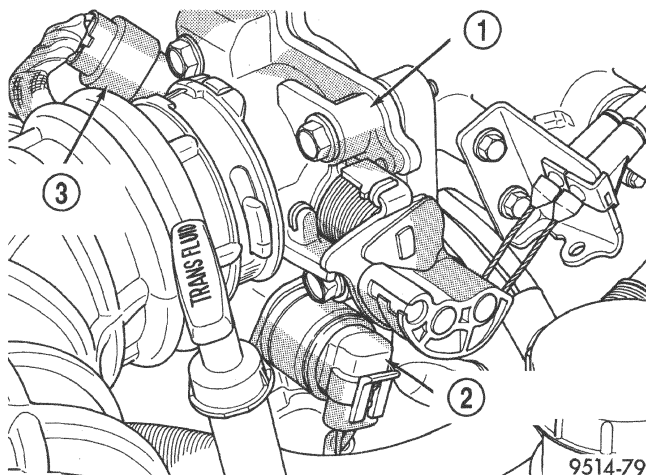
The proportional purge solenoid operates at a frequency of 200 hz and is controlled by an engine controller circuit that senses the current being applied to the proportional purge solenoid and then adjusts that current to achieve the desired purge flow. The proportional purge solenoid controls the purge rate of fuel vapors from the vapor canister and fuel tank to the engine intake manifold.

**IDLE AIR CONTROL MOTOR—PCM OUTPUT****DESCRIPTION**

The Idle Air Control (IAC) motor is mounted on the throttle body. The PCM operates the idle air control motor (Fig. 15) or (Fig. 16).

**Fig. 15 Idle Air Control Motor Air Bypass Passage—2.4L**

- 1 - IDLE AIR CONTROL MOTOR
- 2 - TPS

**DESCRIPTION AND OPERATION (Continued)**

**Fig. 16 Idle Air Control Motor Air Bypass Passage—2.5L**

- 1 - THROTTLE BODY
- 2 - IDLE AIR CONTROL MOTOR
- 3 - THROTTLE POSITION SENSOR

**OPERATION**

The PCM adjusts engine idle speed through the idle air control motor to compensate for engine load, coolant temperature or barometric pressure changes.

The throttle body has an air bypass passage that provides air for the engine during closed throttle idle. The idle air control motor pintle protrudes into the air bypass passage and regulates air flow through it.

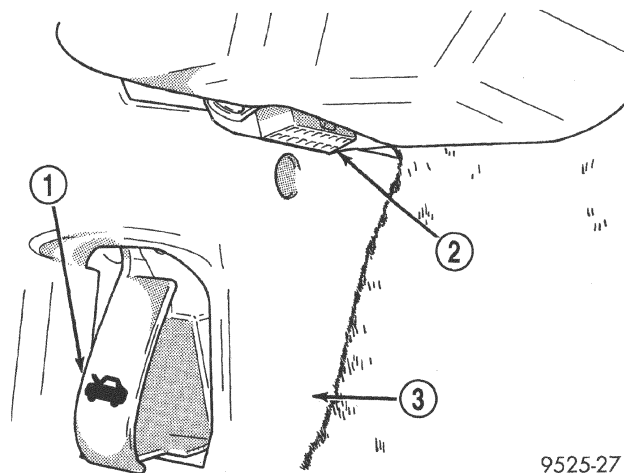
The PCM adjusts engine idle speed by moving the IAC motor pintle in and out of the bypass passage. The adjustments are based on inputs the PCM receives. The inputs are from the throttle position sensor, crankshaft position sensor, coolant temperature sensor, MAP sensor, vehicle speed sensor and various switch operations (brake, park/neutral, air conditioning).

**DATA LINK CONNECTOR****DESCRIPTION**

The data link connector is located inside the vehicle, under the instrument panel, at the driver's kick panel (Fig. 17).

**OPERATION**

The data link connector (diagnostic connector) links the DRB scan tool with the Powertrain Control Module (PCM). Refer to On-Board Diagnostics in the Emission Control section.



**Fig. 17 Data Link (Diagnostic) Connector**

- 1 - HOOD RELEASE
- 2 - DIAGNOSTIC CONNECTOR
- 3 - DRIVER'S SIDE KICK PANEL

**MALFUNCTION INDICATOR (CHECK ENGINE) LAMP—PCM OUTPUT****DESCRIPTION**

Refer to the Instrument Panel Systems for more information.

**OPERATION**

The PCM supplies the malfunction indicator (check engine) lamp on/off signal to the instrument panel through the CCD Bus. The CCD Bus is a communications port. Various modules use the CCD Bus to exchange information.

The Check Engine lamp comes on each time the ignition key is turned ON and stays on for 3 seconds as a bulb test.

The Malfunction Indicator Lamp (MIL) stays on continuously, when the PCM has entered a Limp-In mode or identified a failed emission component. During Limp-in Mode, the PCM attempts to keep the system operational. The MIL signals the need for immediate service. In limp-in mode, the PCM compensates for the failure of certain components that send incorrect signals. The PCM substitutes for the incorrect signals with inputs from other sensors.

If the PCM detects active engine misfire severe enough to cause catalyst damage, it flashes the MIL. At the same time the PCM also sets a Diagnostic Trouble Code (DTC).

**For signals that can trigger the MIL (Check Engine Lamp) refer to the On-Board Diagnostics Chart.**



**DESCRIPTION AND OPERATION (Continued)****RADIATOR FAN RELAYS—PCM OUTPUT****DESCRIPTION**

The radiator fan relays are located in the PDC. The inside top of the PDC cover has a label showing relay and fuse location.

**OPERATION**

The PCM energizes the radiator fans through either the low or high speed radiator fan relay. The PCM controls the ground circuit for the coil side of the relay. Power for both relay coils is supplied through a 10 amp fuse in the PDC. Power for both relay contacts is supplied power through a 40 amp fuse in the PDC. Refer to the Wiring Diagrams for circuit information.

The PCM monitors the A/C compressor discharge (high side) pressure through the air conditioning pressure transducer. Depending on engine coolant temperature and A/C system high side pressure, both fans operate at either low or high speed.

**TACHOMETER—PCM OUTPUT****DESCRIPTION**

Refer to the Instrument panel System for more information.

**OPERATION**

The tachometer receives its information across the CCD Bus from the Body Control Module (BCM). Information on engine RPM is transmitted from the Powertrain Control Module (PCM) across the CCD Bus to the BCM. The BCM calculates the position of the tachometer pointer based on the input from the PCM and adjusts the position of the gauge pointer to the necessary position. This signal is sent over the CCD Bus to the instrument cluster.

**5 VOLT SUPPLY—PCM OUTPUT****OPERATION**

The PCM supplies 5 volts to the following sensors:

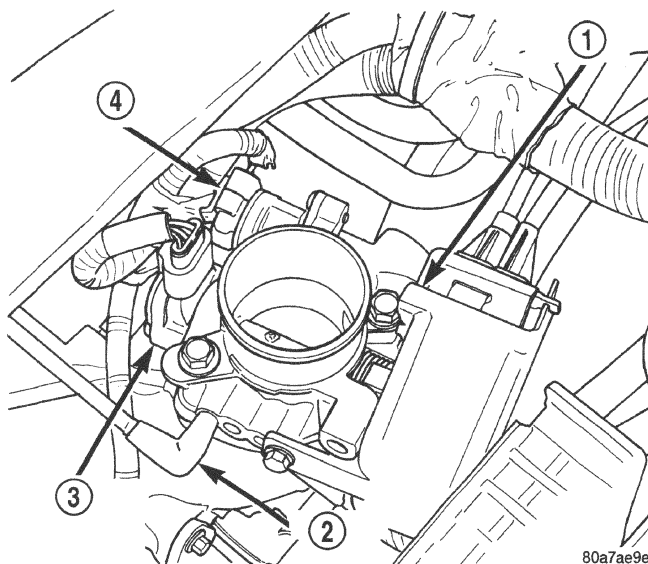
- A/C pressure transducer
- Engine coolant temperature sensor
- Manifold absolute pressure sensor
- Throttle position sensor
- Linear EGR solenoid

**8-VOLT SUPPLY—PCM OUTPUT****OPERATION**

The PCM supplies 8 volts to the crankshaft position sensor, camshaft position sensor.

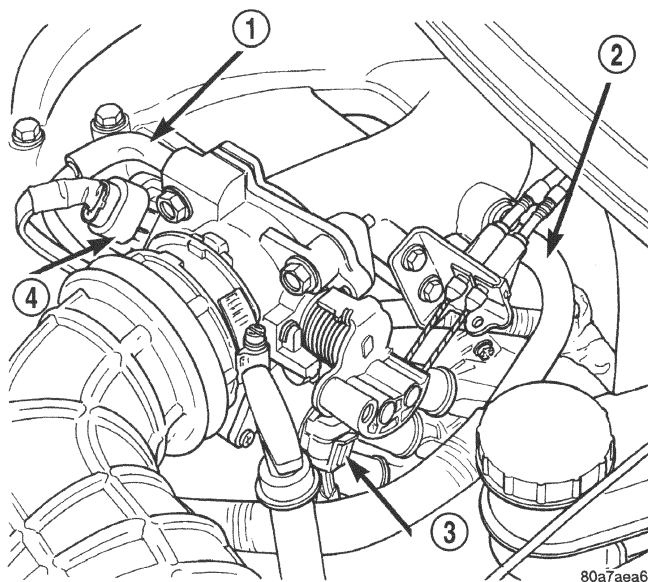
**THROTTLE BODY****DESCRIPTION**

The throttle body mounts to the intake manifold. The throttle position sensor and idle air control motor attach to the throttle body (Fig. 18) or (Fig. 19).



**Fig. 18 Throttle Body—2.4L Engines**

- 1 - THROTTLE SHIELD
- 2 - PURGE HOSE
- 3 - THROTTLE POSITION SENSOR
- 4 - IDLE AIR CONTROL MOTOR



**Fig. 19 Throttle Body—2.5L Engine**

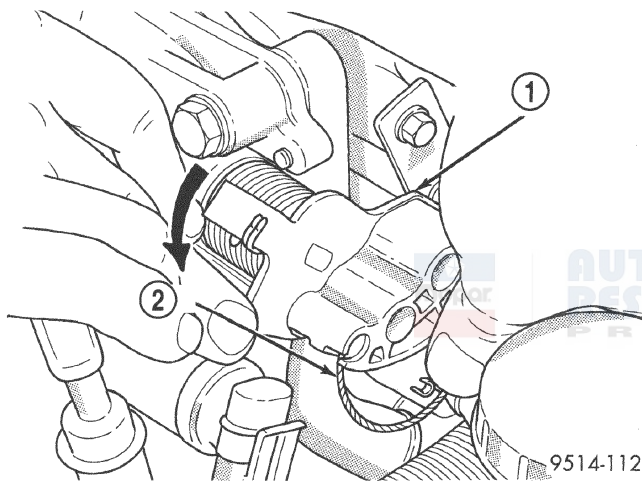
- 1 - PURGE HOSE
- 2 - EGR TUBE
- 3 - AIS
- 4 - TPS

**DESCRIPTION AND OPERATION (Continued)****OPERATION**

At above idle conditions, air flow through the throttle body is controlled by a cable operated throttle blade. During closed throttle idle conditions, the idle air control motor controls air flow. Refer to Idle Air Control Motor in this section.

**REMOVAL AND INSTALLATION****THROTTLE BODY—2.5L ENGINE****REMOVAL**

- (1) Remove the negative battery cable.
- (2) Remove air tube from throttle body.
- (3) Remove throttle cable from the throttle body lever (Fig. 20).

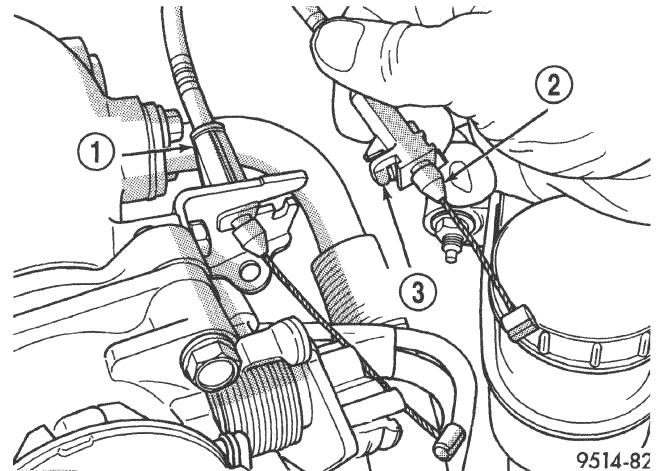
**Fig. 20 Throttle Cable Attachment to Throttle Body**

- 1 - THROTTLE LEVER
- 2 - THROTTLE CABLE

- (4) Push release tang toward dash panel on throttle cable and slide cable out of bracket (Fig. 21).
- (5) Slide speed control cable out of bracket, if equipped (Fig. 21).
- (6) Remove EVAP purge hose from nipple on throttle body.
- (7) Remove connectors from throttle position sensor and idle air control motor.
- (8) Remove bolts holding throttle body to intake manifold. Remove throttle body.

**INSTALLATION**

- (1) Attach electrical connectors to idle air control motor and throttle position sensor.
- (2) Install new gasket.
- (3) Position throttle body on intake and install mounting bolts. Tighten bolts to 28.25 N·m (250 in. lbs.).
- (4) Install speed control cable (if equipped) and throttle cable into throttle lever.

**Fig. 21 Throttle Cable Attachment**

- 1 - SPEED CONTROL CABLE
- 2 - THROTTLE CABLE
- 3 - RELEASE TANG

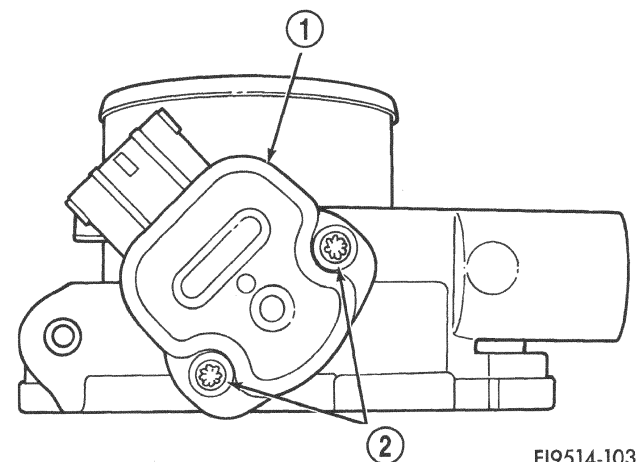
- (5) Install cables into cable bracket.
- (6) Install air inlet tube. Tighten clamps to  $3 \pm 5$  N·m ( $25 \pm 5$  in. lbs.) torque.
- (7) Install the negative battery cable.

**THROTTLE POSITION SENSOR (TPS)—2.5L**

The TPS attaches to the side of the throttle body (Fig. 22).

**REMOVAL**

- (1) Remove the negative battery cable.
- (2) Remove throttle body. Refer to Throttle Body in this section.
- (3) Remove TPS mounting screws.
- (4) Remove throttle position sensor.

**Fig. 22 Throttle Position Sensor—2.5L Engine**

- 1 - THROTTLE POSITION SENSOR
- 2 - RETAINING SCREWS

**REMOVAL AND INSTALLATION (Continued)****INSTALLATION**

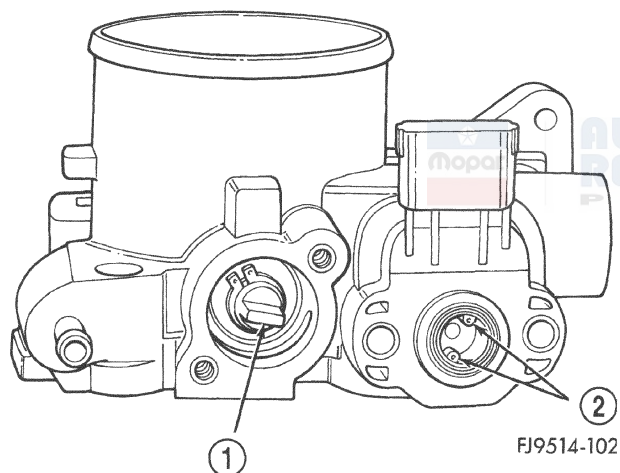
(1) The throttle shaft end of the throttle body slides into a socket in the TPS (Fig. 23). The socket has two tabs inside it. The throttle shaft rests against the tabs. When indexed correctly, the TPS can rotate a few degrees to line up the mounting screw holes with the screw holes in the throttle body. The TPS has slight tension when rotated into position. If it is difficult to rotate the TPS into position, reinstall the sensor with the throttle shaft on the other side of the tabs in the socket of the TPS. Tighten mounting screws to 6.2 N·m (55 in. lbs.) torque.

(2) After installing the TPS, the throttle plate should be closed. If the throttle plate is open, install the sensor on the other side of the tabs in the socket.

(3) Attach electrical connectors to idle air control motor and throttle position sensor.

(4) Install throttle body to intake manifold. Refer to throttle body in this section.

(5) Install the negative battery cable.



**Fig. 23 Indexing Throttle Position Sensor—2.5L Engine**

- 1 - THROTTLE SHAFT  
2 - TABS

**IDLE AIR CONTROL MOTOR—2.0/2.4/2.5L**

The idle air control motor attaches to the side of the throttle body (Fig. 24) or (Fig. 25) or (Fig. 26).

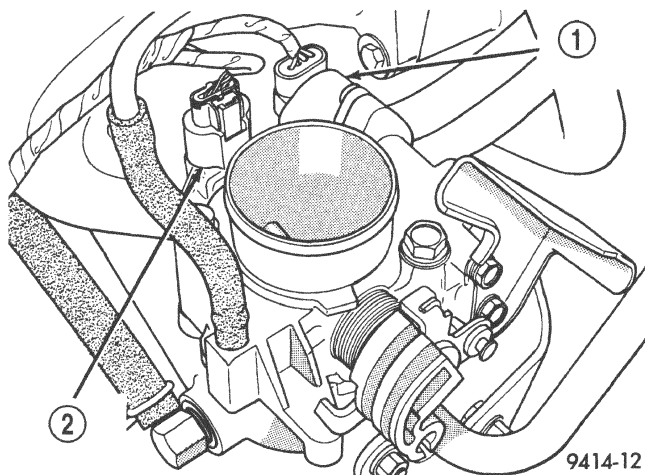
**REMOVAL**

(1) Remove throttle body. Refer to Throttle Body in this section.

(2) Disconnect electrical connector from idle air control motor and throttle position sensor.

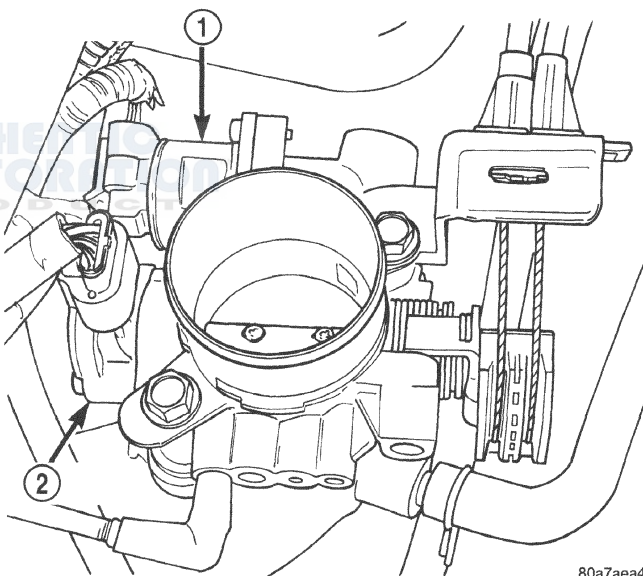
(3) Remove idle air control motor mounting screws.

(4) Remove idle air control motor. Ensure O-ring is removed with the motor.



**Fig. 24 Throttle Position Sensor and Idle Air Control Motor—2.0L**

- 1 - IDLE AIR CONTROL MOTOR  
2 - THROTTLE POSITION SENSOR



**Fig. 25 Throttle Position Sensor and Idle Air Control Motor—2.4L**

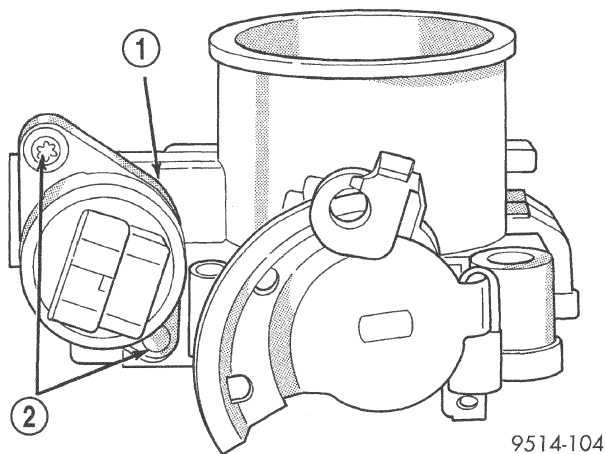
- 1 - IDLE AIR CONTROL MOTOR  
2 - TPS

**INSTALLATION**

(1) The new idle air control motor has a new O-ring installed on it. If pintle measures more than 1 inch (25 mm) it must be retracted. Use the DRB AIS Motor Open/Close Test to retract the pintle (battery must be connected.)

(2) Carefully place idle air control motor into throttle body.



**REMOVAL AND INSTALLATION (Continued)**

**Fig. 26 Throttle Position Sensor and Idle Air Control Motor—2.5L**

- 1 - IDLE AIR CONTROL MOTOR  
2 - RETAINER SCREWS

(3) Install mounting screws. Tighten screws to: 2.0L = 5.3 N·m (45 in. lbs.) 2.4/2.5L = 6.2 N·m (55 in. lbs.) torque.

(4) Attach electrical connectors to idle air control motor and throttle position sensor.

(5) Install throttle body. Refer to Throttle Body in this section.

**INTAKE AIR TEMPERATURE SENSOR—2.5L**

The intake air temperature sensor threads into the intake manifold plenum (Fig. 27).

**REMOVAL**

- (1) Remove the negative battery cable.
- (2) Disconnect electrical connector from sensor.
- (3) Remove sensor.

**INSTALLATION**

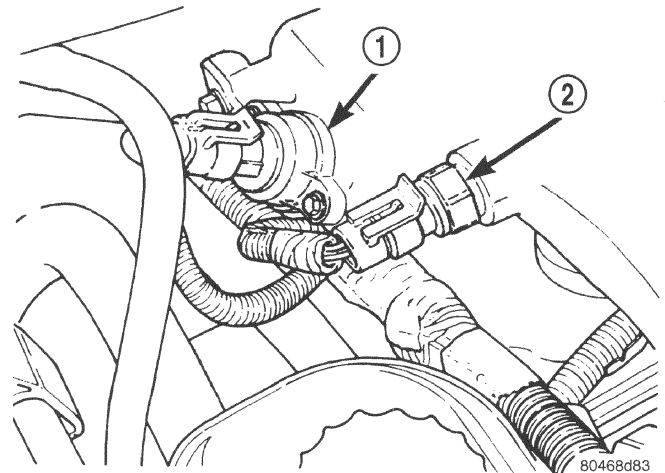
- (1) Install sensor. Tighten sensor to  $12 \pm 1$  N·m ( $9 \pm 1$  ft. lbs.) torque.
- (2) Attach electrical connector to sensor.
- (3) Install the negative battery cable.

**MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR**

The MAP sensor attaches to the intake manifold plenum (Fig. 27).

**REMOVAL**

- (1) Remove the negative battery cable.
- (2) Disconnect electrical connector from MAP sensor.
- (3) Remove sensor mounting screws.
- (4) Remove sensor.



**Fig. 27 Intake Air Temperature Sensor and MAP Sensor—2.5L**

- 1 - MAP SENSOR  
2 - INTAKE AIR TEMPERATURE SENSOR

**INSTALLATION**

(1) Insert sensor into intake manifold while making sure not to damage O-ring seal.

(2) Tighten mounting screws to 3.4 N·m (30 in. lbs) torque.

(3) Attach electrical connector to sensor.

(4) Install the negative battery cable.

**POWERTRAIN CONTROL MODULE**

The PCM engine control strategy prevents reduced idle speeds until after the engine operates for 320 km (200 miles). If the PCM is replaced after 320 km (200 miles) of usage, update the mileage and vehicle identification number (VIN) in the new PCM. Use the DRB scan tool to change the millage and VIN in the PCM. If this step is not done a Diagnostic Trouble Code (DTC) may be set. Refer to the appropriate Powertrain Diagnostic Manual and the DRB scan tool.

The PCM attaches to a bracket between the air cleaner housing and Power Distribution Center (PDC).

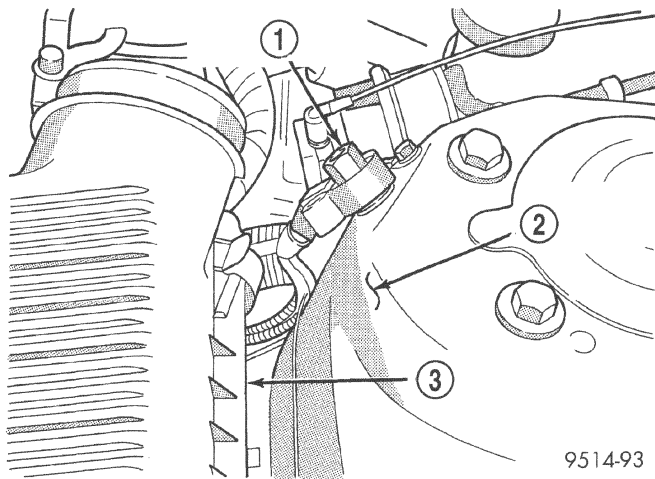
**REMOVAL**

- (1) Disconnect negative cable from auxiliary jumper terminal (Fig. 28).
- (2) Disconnect both 40-way connectors from PCM.
- (3) Remove screws attaching PCM to bracket (Fig. 29).
- (4) Lift PCM up to remove it from vehicle.

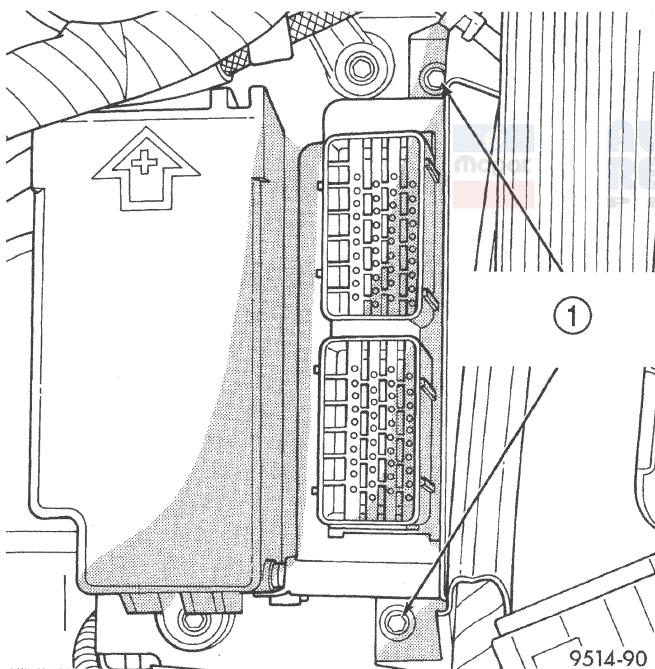
**INSTALLATION**

- (1) Install PCM. Tighten mounting screws.
- (2) Attach both 40-way connectors to PCM.



**REMOVAL AND INSTALLATION (Continued)****Fig. 28 Auxiliary Jumper Terminal**

- 1 - AUXILIARY JUMPER TERMINAL
- 2 - LEFT STRUT TOWER
- 3 - AIR CLEANER HOUSING

**Fig. 29 PCM Bracket Screws**

- 1 - POWERTRAIN CONTROL MODULE BRACKET SCREWS

(3) Connect negative cable to auxiliary jumper terminal.

**OXYGEN SENSOR 1/1 UPSTREAM—2.5L****REMOVAL**

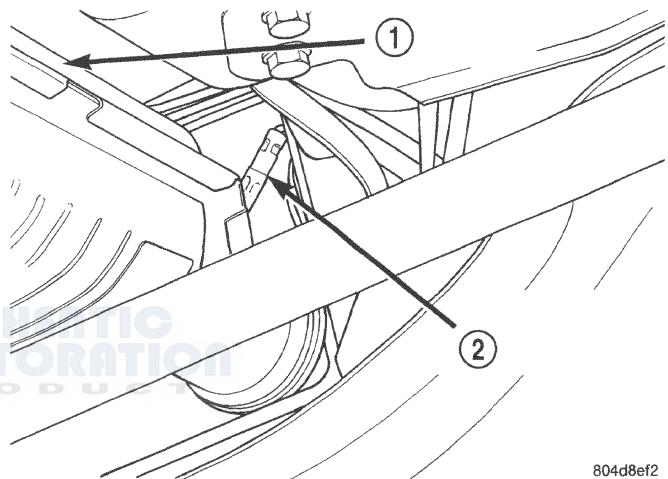
- (1) Remove the negative battery cable.
- (2) Raise and support vehicle.
- (3) Disconnect electrical connector from sensor.

(4) Remove sensor using an oxygen sensor crow foot wrench such as Snap-On tool YA8875 or equivalent (Fig. 30).

**INSTALLATION**

(1) After removing the sensor, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If reusing the original sensor, coat the sensor threads with an anti-seize compound such as Loctite® 771-64 or equivalent. New sensors have compound on the threads and do not require an additional coating. Tighten the sensor to 28 N·m (20 ft. lbs.) torque.

- (2) Connect electrical connector to sensor.
- (3) Lower vehicle.
- (4) Install the negative battery cable.

**Fig. 30 Oxygen Sensor 1/1 Upstream**

- 1 - CATALYTIC CONVERTOR
- 2 - UPSTREAM HEATED OXYGEN SENSOR

**OXYGEN SENSOR 1/2 DOWNSTREAM**

The downstream heated oxygen sensor threads into the exhaust pipe behind the catalytic convertor.

**REMOVAL**

- (1) Remove the negative battery cable.
- (2) Raise vehicle.
- (3) Disconnect electrical connector from sensor.
- (4) Disconnect sensor electrical harness from clips along body.
- (5) Remove sensor using an oxygen sensor crow foot wrench such as Snap-On tool YA8875 or equivalent (Fig. 31).

**INSTALLATION**

(1) After removing the sensor, the exhaust manifold threads must be cleaned with an 18 mm X 1.5 + 6E tap. If reusing the original sensor, coat the sensor threads with an anti-seize compound such as Loctite® 771-64 or equivalent. New sensors have compound on

**REMOVAL AND INSTALLATION (Continued)**

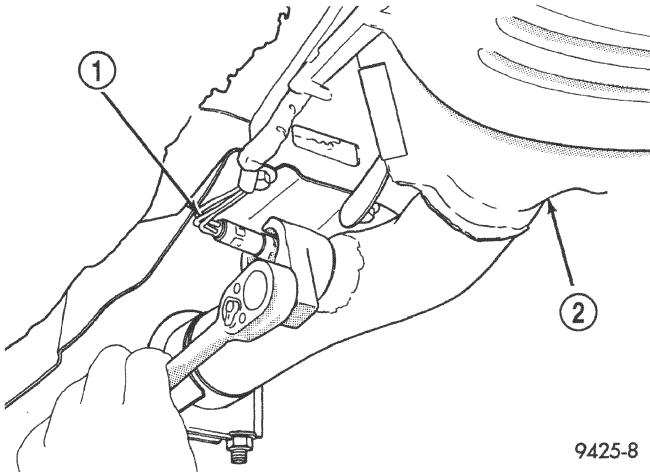
the threads and do not require an additional coating. Tighten the sensor to 28 N·m (20 ft. lbs.) torque.

(2) Connect sensor electrical harness to clips along body.

(3) Connect electrical connector to sensor.

(4) Lower vehicle.

(5) Install the negative battery cable.



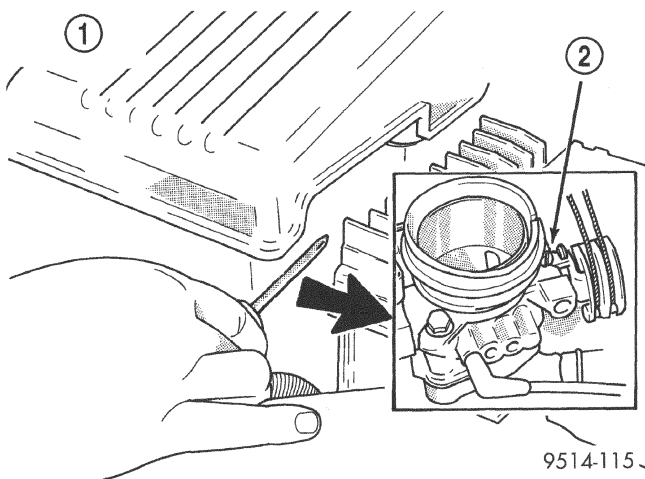
9425-8

**Fig. 31 Oxygen Sensor 1/2 Downstream**

- 1 - DOWNSTREAM HEATED OXYGEN SENSOR  
2 - CATALYTIC CONVERTOR

**AIR INLET RESONATOR****2.0L****REMOVAL**

(1) Loosen screw holding resonator to throttle body (Fig. 32).



9514-115

**Fig. 32 Air Inlet Resonator Attachment to Throttle Body**

- 1 - AIR INLET RESONATOR  
2 - RESONATOR CLAMP SCREW

(2) Loosen clamp holding resonator to air inlet tube. Remove resonator.

**INSTALLATION**

(1) Install air inlet resonator to throttle body.

(2) Install air inlet tube to resonator.

(3) Tighten clamps to  $3 \pm 0.5$  N·m ( $25 \pm 5$  in. lbs.) torque.

**2.4L****REMOVAL**

(1) Remove bolt holding air inlet resonator to intake manifold.

(2) Loosen screw holding resonator to throttle body (Fig. 32).

(3) Loosen clamp holding resonator to air inlet tube. Remove resonator.

**INSTALLATION**

(1) Install air inlet resonator to throttle body.

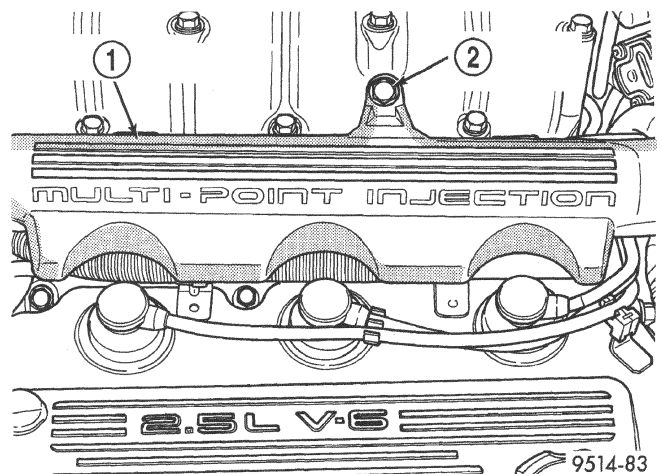
(2) Install air inlet tube to resonator.

(3) Tighten clamps to  $3 \pm 0.5$  N·m ( $25 \pm 5$  in. lbs.) torque.

(4) Install bolt and tighten.

**2.5L****REMOVAL**

(1) Remove bolt holding resonator to intake manifold (Fig. 33).



9514-83

**Fig. 33 Air Inlet Resonator**

- 1 - AIR INLET RESONATOR  
2 - RESONATOR BOLT

(2) Loosen clamp holding resonator to air inlet tube. Remove resonator.

**INSTALLATION**

(1) Install air inlet tube to resonator.



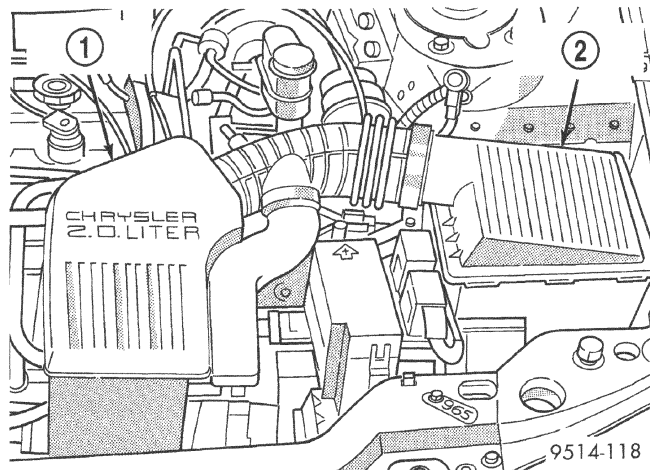
**REMOVAL AND INSTALLATION (Continued)**

(2) Tighten clamp to  $3\pm.5$  N·m ( $25\pm5$  in. lbs.) torque.

(3) Install bolt holding resonator to intake manifold. Tighten to  $5\pm.5$  N·m ( $45\pm5$  in. lbs.) torque.

**AIR CLEANER**

The air cleaner housing attaches to the inner fender in front of the driver's side strut tower (Fig. 34). An ambient air duct supplies underhood air for the engine.

**Fig. 34 Air Inlet System**

- 1 - AIR INLET RESONATOR
- 2 - AIR CLEANER HOUSING

**FILTER ELEMENT REPLACEMENT****REMOVAL**

- (1) Unfasten clasps on rear of air cleaner housing cover. Lift cover off air cleaner housing (Fig. 35).
- (2) Remove filter element (Fig. 36).
- (3) If necessary, clean the inside of the air cleaner housing.

**INSTALLATION**

- (1) Install new filter element.
- (2) Place cover over air cleaner housing. Snap clasps in place.

**ENGINE COOLANT TEMPERATURE SENSOR****2.4L**

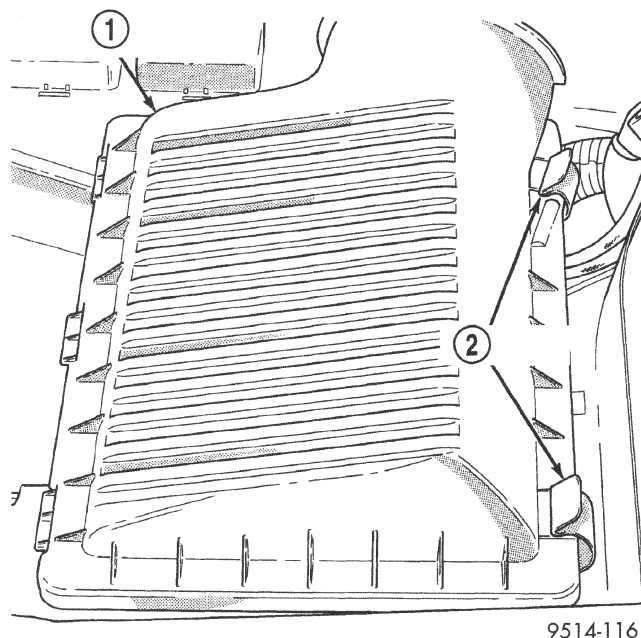
The engine coolant temperature sensor threads into the front of the cylinder head (Fig. 37).

**2.5L**

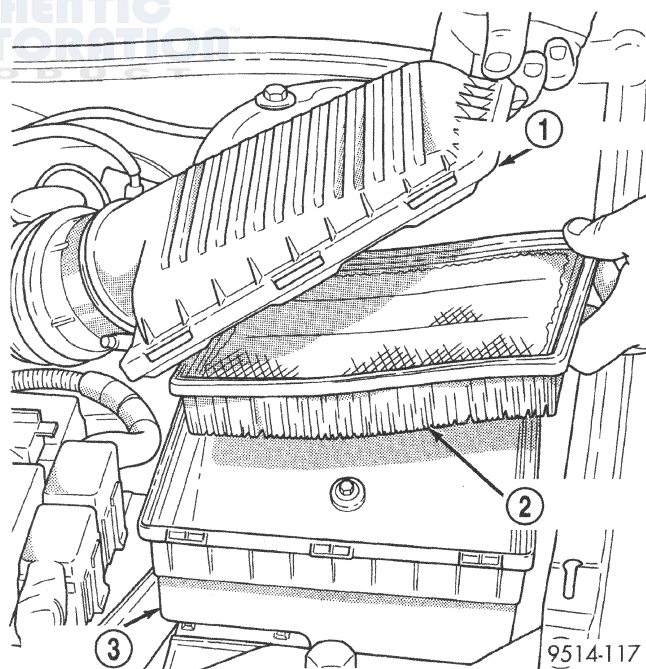
The engine coolant temperature sensor is located next to the fill neck (Fig. 38).

**REMOVAL**

- (1) With the engine cold, drain coolant until level drops below sensor level. Refer to the Cooling System section.

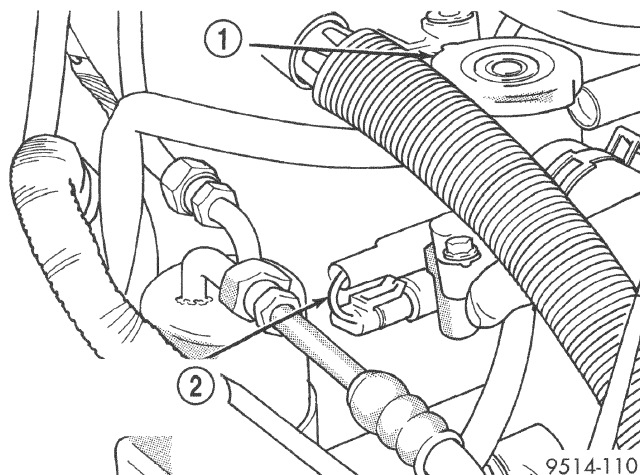
**Fig. 35 Air Cleaner Cover Clasps**

- 1 - AIR CLEANER HOUSING COVER
- 2 - CLASPS

**Fig. 36 Air Cleaner Housing and Element**

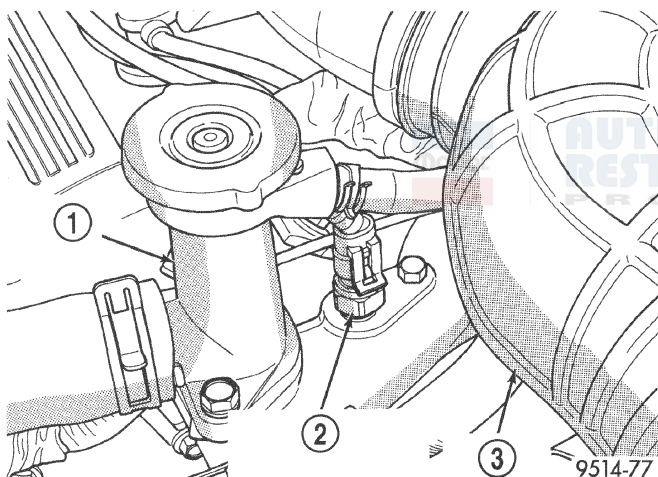
- 1 - HOUSING COVER
- 2 - AIR CLEANER ELEMENT
- 3 - HOUSING

- (2) Disconnect coolant sensor electrical connector.
- (3) Remove coolant sensor.

**REMOVAL AND INSTALLATION (Continued)**

**Fig. 37 Engine Coolant Temperature Sensor—2.4L Engine**

- 1 - COOLANT FILLER CAP  
2 - ENGINE COOLANT TEMPERATURE SENDING UNIT



**Fig. 38 Engine Coolant Temperature Sensor—2.5L Engine**

- 1 - COOLANT FILL NECK  
2 - ENGINE COOLANT TEMPERATURE SENSOR  
3 - AIR INLET TUBE

**INSTALLATION**

- (1) Install coolant sensor. Tighten sensor to:  
(2) **2.4L** 27 N·m (20 ft. lbs.) torque.

- (3) **2.5L** 7 N·m (60 in. lbs.) torque.  
(4) Attach electrical connector to sensor.  
(5) Fill cooling system. Refer to the Cooling System section.

**SPECIFICATIONS****VEHICLE EMISSION CONTROL INFORMATION LABEL****DESCRIPTION**

All models have a Vehicle Emission Control Information (VECI) Label. Chrysler permanently attaches the label in the engine compartment. It cannot be removed without defacing information and destroying the label.

The label contains the vehicle's emission specifications and vacuum hose routings. All hoses must be connected and routed according to the label.

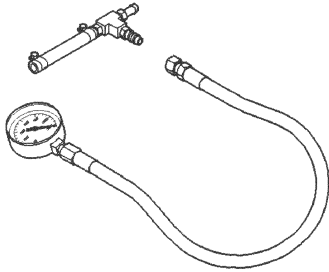
**TORQUE****DESCRIPTION****TORQUE**

Camshaft Position Sensor . . .	12 N·m (105 in. lbs.)
Crankshaft Position Sensor . .	12 N·m (105 in. lbs.)
Engine Coolant Temperature Sensor . . . . .	28 N·m (20 ft. lbs.)
IAC Motor-To-Throttle Body Bolts . . . . .	3 N·m (25 in. lbs.)
MAP Sensor Mounting Screws . .	3 N·m (25 in. lbs.)
Oxygen Sensor . . . . .	28 N·m (20 ft. lbs.)
Powertrain Control Module (PCM) Mounting Screws . . . . .	4 N·m (35 in. lbs.)
Throttle Body Mounting Bolts . .	26 N·m (19 ft. lbs.)
Throttle Position Sensor . . . . .	3 N·m (25 in. lbs.)
Throttle Shield Bolt . . . . .	4.5 N·m (40 in. lbs.)

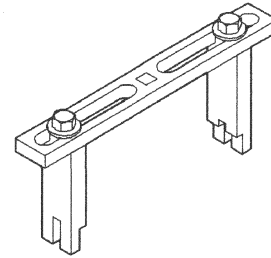


## SPECIAL TOOLS

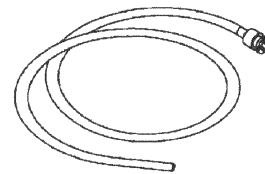
### FUEL



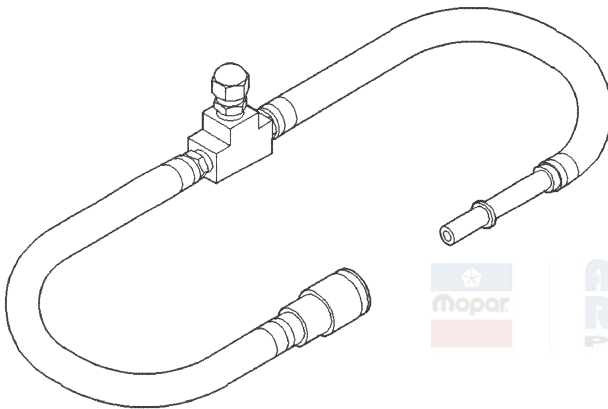
*Pressure Gauge Assembly C-4799-B*



*Spanner Wrench 6856*



*Fuel Line Adapter 1/4*



*Fuel Pressure Test Adapter 6539*



**AUTHENTIC  
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*O2S (Oxygen Sensor) Remover/Installer—C-4907*

## STEERING

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## POWER STEERING

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## DESCRIPTION AND OPERATION

### POWER STEERING SYSTEM

#### DESCRIPTION

This vehicle is equipped with either standard power steering or speed-sensitive variable-assist power steering. Early production vehicles are equipped with speed-sensitive variable-assist power steering only, while later production vehicles are equipped with standard power steering only. The variable-assist feature on the early production vehicles is built into the power steering pump. Refer to POWER STEERING PUMP for additional information on speed-sensitive variable-assist power steering.

The power steering system consists of these major components:

- POWER STEERING PUMP
- POWER STEERING GEAR

- POWER STEERING FLUID RESERVOIR
- POWER STEERING FLUID SUPPLY HOSE
- POWER STEERING FLUID PRESSURE HOSE
- POWER STEERING FLUID RETURN HOSE
- POWER STEERING FLUID COOLER
- POWER STEERING FLUID COOLER TUBES

For information on the first two components, refer to their respective sections within this service manual group. Information on the third component can be found in POWER STEERING PUMP. Information on all other components, and all diagnosis and testing can be found in this section of this service manual group.

#### OPERATION

Turning of the steering wheel is converted into linear travel through the meshing of the helical pinion teeth with the rack teeth. Power assist steering is provided by an open center, rotary type control valve.

## DESCRIPTION AND OPERATION (Continued)

It is used to direct oil from the power steering pump to either side of the integral steering rack piston.

Road feel is controlled by the diameter of a torsion bar which initially steers the vehicle. As steering effort increases as in a turn, the torsion bar twists, causing relative rotary motion between the rotary valve body and valve spool. This movement directs oil behind the integral rack piston, which in turn builds up hydraulic pressure and assists in the turning effort.

Refer to POWER STEERING PUMP for information on the operation of the speed-sensitive variable-assist power steering.

## POWER STEERING FLUID HOSES

### DESCRIPTION

The power steering fluid hoses connect the components of the power steering system.

The power steering fluid supply hose is a special rubber hose that connects the power steering fluid reservoir to the power steering pump. The hose is secured at each end using a standard adjustable clamp.

The power steering fluid pressure hose is a high pressure hose that connects the power steering pump to the gear. At both ends of the flexible hose portion are steel fittings that are pressure crimped to the flexible hose. A standard tube nut fitting with an O-ring is used at each end to connect it to either the power steering pump or the gear.

The power steering fluid return hose is a special rubber hose that connects the power steering gear and the power steering fluid cooler, back to the fluid reservoir. A standard tube nut fitting with an O-ring is used to connect it to the power steering gear. The hose is secured to the cooler and reservoir using standard adjustable clamps.

### OPERATION

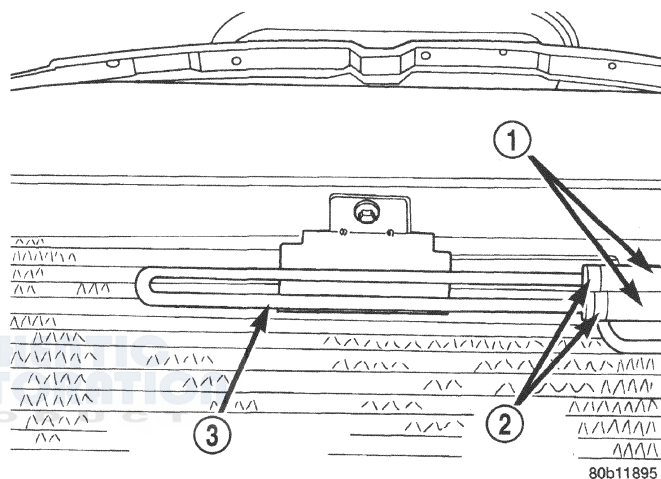
The power steering fluid hoses transfer fluid from one power steering system component to the next.

## POWER STEERING FLUID COOLER

### DESCRIPTION

The purpose of the power steering cooler is to keep the temperature of the power steering system fluid from rising to a level that would affect the performance of the power steering system.

The cooler is placed in series with the power steering fluid return hose, between the steering gear fluid outlet port and the power steering fluid reservoir. It is mounted to the bumper reinforcement in front of the radiator (Fig. 1). The cooler is secured to the power steering fluid return hose using standard adjustable clamps or crimp clamps.



**Fig. 1 Power Steering Fluid Cooler**

- 1 - POWER STEERING FLUID HOSES
- 2 - CRIMP CLAMPS
- 3 - POWER STEERING FLUID COOLER

### OPERATION

The cooler used on this vehicle is referred to as a fluid-to-air type cooler. This means that the air flow across the tubes of the cooler is used to extract the heat from the cooler which it has absorbed from the power steering fluid flowing through it. The temperature of the power steering fluid is lowered prior to it entering the power steering fluid reservoir where it is resupplied to the power steering pump.

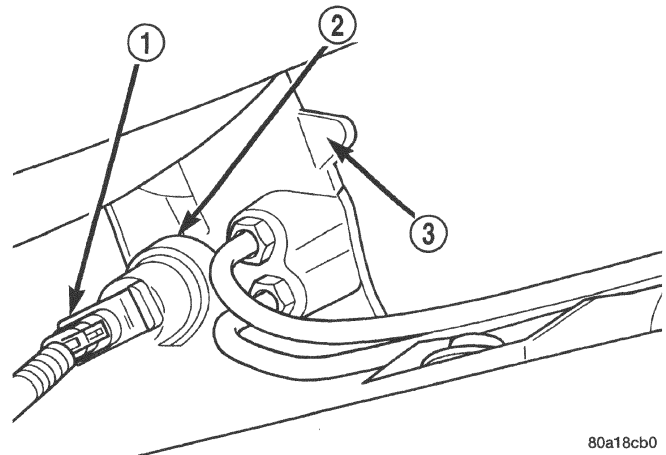
**DESCRIPTION AND OPERATION (Continued)****POWER STEERING FLUID PRESSURE SWITCH****DESCRIPTION**

On vehicles equipped with power steering, a power steering pressure switch (Fig. 2) is used to improve the vehicle's idle quality when required. When a demand for power assist is put on the power steering system at idle, pump pressure puts additional load on the engine, thus decreasing engine idle speed. The pressure switch improves vehicle idle quality by maintaining the required engine idle speed when the pressure rises in the power steering system.

The power steering pressure switch is mounted directly to the power steering gear (Fig. 2).

**OPERATION**

The pressure switch functions by signaling the powertrain control module that the power steering system is putting additional load on the engine. This type of condition exists when turning the front tires of the vehicle when the vehicle is stationary and the engine is at idle speed. When this condition is sensed by the power train control module, through a signal from the power steering pressure switch, engine idle speed will be maintained. The maintained engine idle



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**Fig. 2 Power Steering Pressure Switch Location**

- 1 - WIRING HARNESS CONNECTOR
- 2 - POWER STEERING PRESSURE SWITCH
- 3 - POWER STEERING GEAR

speed compensates for the additional load, thus maintaining the required engine idle speed and idle quality.



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## DIAGNOSIS AND TESTING

### STEERING SYSTEM DIAGNOSIS CHARTS

#### POWER STEERING NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
OBJECTIONABLE HISS OR WHISTLE*	<ol style="list-style-type: none"> <li>1. Damaged or mispositioned steering column shaft/coupling dash panel seal.</li> <li>2. Noisy valve in power steering gear.</li> </ol>	<ol style="list-style-type: none"> <li>1. Reposition or replace steering column shaft/coupling dash panel seal.</li> <li>2. Replace power steering gear.</li> </ol>
RATTLE OR CLUNK	<ol style="list-style-type: none"> <li>1. Power steering gear loose on front suspension crossmember.</li> <li>2. Front suspension crossmember mounting fasteners loose at frame.</li> <li>3. Loose tie rod (outer or inner).</li> <li>4. Loose lower control arm mounting bolts at front suspension crossmember.</li> <li>5. Loose shock assembly mounting fasteners at shock tower.</li> <li>6. Power steering fluid pressure hose touching the body of the vehicle.</li> <li>7. Internal power steering gear noise.</li> <li>8. Damaged front suspension crossmember.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inspect power steering gear mounting bolts. Replace as necessary. Tighten to the specified torque.</li> <li>2. Tighten the front suspension crossmember mounting fasteners to the specified torque.</li> <li>3. Check tie rod pivot points for wear. Replace worn/loose parts as required.</li> <li>4. Tighten control arm mounting bolts to the specified torques.</li> <li>5. Tighten shock assembly fasteners to the specified torques.</li> <li>6. Adjust hose to proper position by loosening, repositioning, and tightening fitting to specified torque. Do not bend tubing.</li> <li>7. Replace power steering gear.</li> <li>8. Replace front suspension crossmember.</li> </ol>
POPPING NOISE	<ol style="list-style-type: none"> <li>1. Worn outer tie rod.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace outer tie rod.</li> </ol>
CHIRP OR SQUEAL (POWER STEERING PUMP)	<ol style="list-style-type: none"> <li>1. Loose power steering pump drive belt.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and adjust power steering pump drive belt to specifications. Replace belt if worn or glazed.</li> </ol>
WHINE OR GROWL (POWER STEERING PUMP)**	<ol style="list-style-type: none"> <li>1. Low fluid level.</li> <li>2. Power steering hose touching vehicle body or frame.</li> <li>3. Extreme wear of power steering pump internal components.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fill power steering fluid reservoir to proper level and check for leaks (make sure all air is bled from the system fluid).</li> <li>2. Adjust hose to proper position by loosening, repositioning, and tightening fitting to specified torque. Do not bend tubing. Replace hose if damaged.</li> <li>3. Replace power steering pump and flush system as necessary.</li> </ol>

**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSES	CORRECTION
SUCKING AIR SOUND	<ol style="list-style-type: none"> <li>1. Loose clamp on power steering fluid return hose.</li> <li>2. Missing O-Ring on power steering hose connection.</li> <li>3. Low power steering fluid level.</li> <li>4. Air leak between power steering fluid reservoir and power steering pump.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten or replace hose clamp.</li> <li>2. Inspect connection and replace O-Ring as required.</li> <li>3. Fill power steering fluid reservoir to proper level and check for leaks.</li> <li>4. Replace power steering pump (with reservoir).</li> </ol>
SQUEAK OR RUBBING SOUND	<ol style="list-style-type: none"> <li>1. Steering column shroud rubbing.</li> <li>2. Steering column shaft rubbing.</li> <li>3. Clockspring noisy.</li> <li>4. Steering gear internally noisy.</li> </ol>	<ol style="list-style-type: none"> <li>1. Realign shrouds as necessary.</li> <li>2. Move or realign item rubbing shaft.</li> <li>3. Remove clockspring. Reinstall wheel. If noise is gone, replace clockspring.</li> <li>4. Replace steering gear.</li> </ol>
SCRUBBING OR KNOCKING NOISE.	<ol style="list-style-type: none"> <li>1. Incorrect tire or wheel size.</li> <li>2. Interference between steering gear and other vehicle components.</li> <li>3. Steering gear internal stops worn excessively allowing tires to be steered excessively far.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace incorrect size tire or wheel with size used as original equipment.</li> <li>2. Check for bent or misaligned components and correct as necessary.</li> <li>3. Replace steering gear.</li> </ol>

**\*NOTE:** There is some noise in all power steering systems. One of the most common is a hissing sound evident when turning the steering wheel when at a standstill or when parking and the steering wheel is at the end of its travel. Hiss is a very high frequency noise similar to that experienced while slowly closing a water tap. The noise is present in every valve and results when high velocity fluid passes valve orifice edges. There is no relationship between this noise and the performance of the steering system.

**\*\*NOTE:** Power steering pump growl results from the development of high pressure fluid flow. Normally this noise level should not be high enough to be objectionable.

**DIAGNOSIS AND TESTING (Continued)****STEERING WHEEL FEEL**

CONDITION	POSSIBLE CAUSES	CORRECTION
STEERING WHEEL/ COLUMN CLICKING, CLUNKING OR RATTLING.	<ol style="list-style-type: none"> <li>1. Steering column preload is not set properly.</li> <li>2. Loose steering coupling pinch bolt.</li> <li>3. Steering column bearings.</li> </ol>	<ol style="list-style-type: none"> <li>1. Loosen steering column coupling pinch bolt to reset steering column preload. Replace pinch bolt and torque to specifications.</li> <li>2. Replace pinch bolt and torque to specifications.</li> <li>3. Replace steering column.</li> </ol>
STEERING WHEEL HAS FORE AND AFT LOOSENESS.	<ol style="list-style-type: none"> <li>1. Steering wheel retaining nut not properly tightened and torqued.</li> <li>2. Steering column preload is not set properly.</li> <li>3. Steering column lower bearing spring retainer slipped on steering column shaft.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten the steering wheel retaining nut to its specified torque.</li> <li>2. Loosen steering column coupling pinch bolt to reset steering column preload. Replace pinch bolt and torque to specifications.</li> <li>3. Replace steering column.</li> </ol>
STEERING WHEEL OR DASH VIBRATES DURING LOW SPEED OR STANDSTILL STEERING MANEUVERS.	<ol style="list-style-type: none"> <li>1. Air in the fluid of the power steering system.</li> <li>2. Tires not properly inflated.</li> <li>3. Excessive engine vibration.</li> <li>4. Loose tie rod end jam nut.</li> <li>5. Overcharged air conditioning system.</li> </ol>	<ol style="list-style-type: none"> <li>1. Bleed air from system following the power steering pump initial operation service procedure.*</li> <li>2. Inflate tires to the specified pressure.</li> <li>3. Ensure that the engine is running properly.</li> <li>4. Tighten the inner to outer tie rod jam nut to the specified torque.</li> <li>5. Check air conditioning pump head pressure and correct as necessary.</li> </ol>
STEERING CATCHES, STICKS IN CERTAIN POSITIONS OR IS DIFFICULT TO TURN.	<ol style="list-style-type: none"> <li>1. Low power steering fluid level.</li> <li>2. Tires not inflated to specified pressure.</li> <li>3. Lack of lubrication in front suspension control arm ball joints.</li> <li>4. Worn upper or lower control arm ball joint.</li> <li>5. Lack of lubrication in steering gear outer tie rod ends.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fill power steering fluid reservoir to specified level and check for leaks.</li> <li>2. Inflate tires to the specified pressure.</li> <li>3. Lubricate ball joints if ball joints are not a lubricated-for-life type ball joint. If ball joint is a lubricated-for-life ball joint, replace ball joint or control arm.</li> <li>4. Replace ball joint or control arm.</li> <li>5. Lubricate tie rod ends if they are not a lubricated-for-life type. If tie rod end is a lubricated-for-life type, replace tie rod end.</li> </ol>

**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSES	CORRECTION
	6. Loose power steering pump drive belt. 7. Faulty power steering pump flow control (Follow Power Steering System Flow and Pressure Test procedure). 8. Excessive friction in steering column or intermediate shaft. 9. Binding upper or lower control arm ball joint. 10. Excessive friction in power steering gear.	6. Tighten the power steering pump drive belt to specifications. If drive belt is worn or glazed, replace belt. 7. Replace power steering pump. 8. Isolate and correct condition. 9. Replace the upper or lower ball joint. 10. Replace power steering gear.
STIFF, HARD TO TURN, SURGE, MOMENTARY INCREASE IN EFFORT WHEN TURNING.	1. Tires not properly inflated. 2. Low power steering fluid level. 3. Loose power steering pump drive belt. 4. Lack of lubrication in control arm ball joints. 5. Low power steering pump pressure (Follow Power Steering System Flow and Pressure Test procedure). 6. High internal leak in power steering gear (Follow Power Steering System Flow and Pressure Test procedure).	1. Inflate tires to specified pressure. 2. Add power steering fluid as required to power steering fluid reservoir to obtain proper level. Check for leaks. 3. Tighten the power steering pump drive belt to specifications. If drive belt is worn or glazed, replace belt. 4. Lubricate ball joints if ball joints are not a lubricated-for-life type ball joint. If ball joint is a lubricated-for-life ball joint, replace ball joint or control arm. 5. Replace the power steering pump as necessary. 6. Replace power steering gear.
STEERING WHEEL DOES NOT RETURN TO CENTER POSITION.	1. Tires not inflated properly. 2. Improper front wheel alignment. 3. Lack of lubrication in front suspension control arm ball joints. 4. Steering column coupling joints misaligned. 5. Steering wheel rubbing.**	1. Inflate tires to specified pressure. 2. Check and adjust wheel alignment as necessary. 3. Lubricate ball joints if ball joints are not a lubricated for life type of ball joint. If ball joint is a lubricated for life ball joint, replace ball joint or control arm. 4. Realign steering column coupling joints. 5. Adjust steering column shrouds to eliminate rubbing condition.



**DIAGNOSIS AND TESTING (Continued)**

CONDITION	POSSIBLE CAUSES	CORRECTION
	6. Damaged, mis-positioned or un-lubricated steering column coupler to dash seal.** 7. Binding upper or lower control arm ball joint. 8. Tight shaft bearing in steering column. 9. Excessive friction in steering column coupling. 10. Excessive friction in power steering gear.	6. Replace, reposition, or lubricate dash seal. 7. Replace the upper or lower control arm ball joint. 8. Replace the steering column. 9. Replace steering column coupling. 10. Replace power steering gear.
EXCESSIVE STEERING WHEEL KICKBACK OR TOO MUCH STEERING WHEEL FREE PLAY.	1. Air in the fluid of the power steering system. 2. Power steering gear loose on front suspension crossmember. 3. Steering column coupling worn, broken or loose. 4. Free play in steering column. 5. Worn control arm ball joints. 6. Loose steering knuckle to ball joint stud pinch bolt. 7. Front wheel bearings loose or worn. 8. Loose outer tie rod ends. 9. Loose inner tie rod ends. 10. Defective steering gear rotary valve.	1. Bleed air from system following the power steering pump initial operation service procedure.* 2. Inspect power steering gear mounting bolts. Replace as necessary. Tighten to the specified torque. 3. Replace steering column coupling. 4. Check all components of the steering system and repair or replace as required. 5. Replace ball joint or control arm as required. 6. Inspect pinch bolts, replace as necessary, and tighten to specified torque. 7. Replace wheel bearing or knuckle as necessary. 8. Replace outer tie rod ends that have excessive free play. 9. Replace power steering gear. 10. Replace power steering gear.

**\*NOTE:** Steering shudder can be expected in new vehicles and vehicles with recent steering system repairs. Shudder should dissipate after the vehicle has been driven several weeks.

**\*\*NOTE:** To evaluate this condition, it may be necessary to disconnect the coupling at the base of the steering column. Turn the steering wheel and feel or listen for internal rubbing in steering column. To avoid damaging the column clockspring, note the following. Before disconnecting coupling, place tires in the straight-ahead position and center steering wheel. Once disconnected, **DO NOT** rotate steering wheel more than one revolution in either

direction and place steering wheel in original location before reconnecting coupling. If this position is lost, the steering column clockspring must be recentered following the procedure found within the procedure for steering column installation in the steering column section.

**DIAGNOSIS AND TESTING (Continued)****POWER STEERING FLUID**

CONDITION	POSSIBLE CAUSES	CORRECTION
LOW FLUID LEVEL WITH VISIBLE LEAK.	<ol style="list-style-type: none"> <li>1. Loose power steering hose fittings.</li> <li>2. Damaged or missing fitting seal, gasket, or O-ring.</li> <li>3. Power steering pump or power steering gear leaking.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tighten the fitting to its specified torque.</li> <li>2. Replace as necessary.</li> <li>3. Repair or replace the leaking component as required.</li> </ol>
AERATED FLUID.	<ol style="list-style-type: none"> <li>1. Low fluid level.*</li> <li>2. Air leak between power steering fluid reservoir and pump.</li> <li>3. Cracked power steering pump housing.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fill power steering fluid reservoir to proper level.</li> <li>2. Inspect for proper sealing. Replace the power steering pump (with reservoir).</li> <li>3. Replace the power steering pump.</li> </ol>
RESERVOIR FLUID OVERFLOW AND FLUID THAT IS MILKY IN COLOR	<ol style="list-style-type: none"> <li>1. Water contamination.</li> </ol>	<ol style="list-style-type: none"> <li>1. Drain the power steering fluid from the system. Flush the system with fresh clean power steering fluid, drain, then refill to the proper level.</li> </ol>

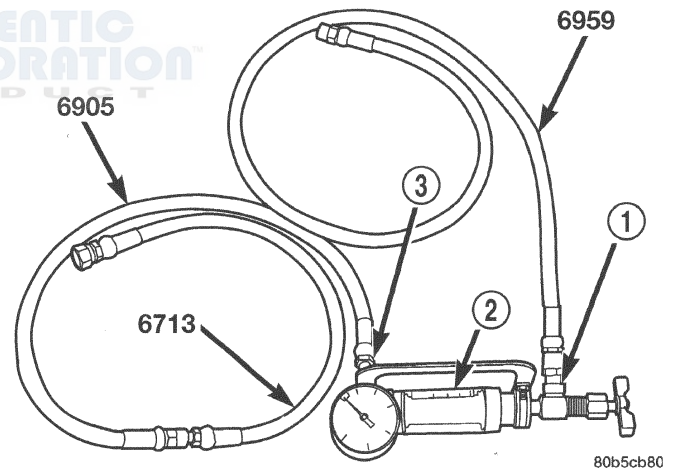
**\*NOTE:** Extremely cold temperatures may cause power steering fluid aeration if the power steering fluid is low.

**POWER STEERING SYSTEM FLOW AND PRESSURE TEST**

The following procedure is to be used to test the operation of the power steering system on this vehicle. This test will provide the flow rate of the power steering pump along with the maximum relief pressure. This test is to be performed any time a power steering system problem is present to determine if the power steering pump or power steering gear is not functioning properly. The following flow and pressure test is performed using the Power Steering Analyzer Kit, Special Tool 6815 (Fig. 3), hoses, Special Tools 6905 and 6959, adapters, Special Tool's 6972 and 8354, and fittings from adapter kit, Special Tool 6893.

(1) Assemble hoses on Power Steering Analyzer, Special Tool 6815, as shown. Install Pressure Hose, Special Tool 6905 (in 6893 kit), in the inlet fitting on Power Steering Analyzer. Install Pressure Hose, Special Tool 6713 (in 6815 kit) on Pressure Hose, Special Tool 6905. Install Pressure Hose, Special Tool 6959, in the outlet fitting on Power Steering Analyzer.

**CAUTION:** To prevent personal injury, safety goggles should be worn at all times when performing any test procedures on the power steering system.



**Fig. 3 Power Steering Analyzer With Hoses Installed**

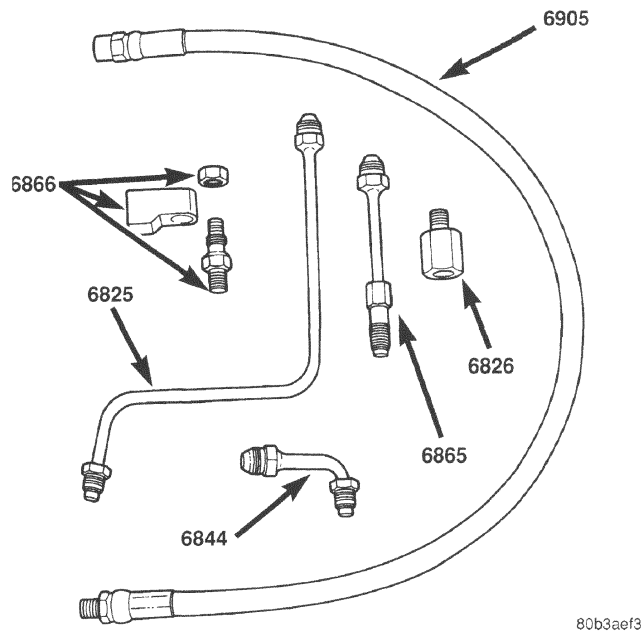
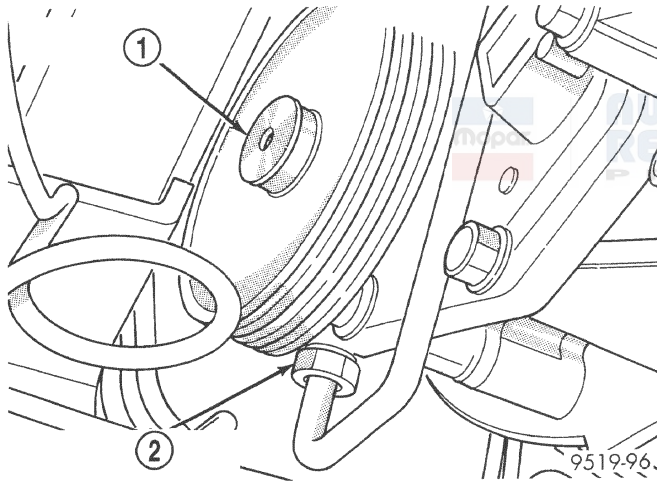
- 1 - OUTLET
- 2 - SPECIAL TOOL 6815
- 3 - INLET

**VEHICLES WITHOUT VARIABLE-ASSIST POWER STEERING**

(1) Install the following adapters from Adapter Set, Special Tool 6893 (Fig. 4), on the analyzer hose ends:

- Install Adapter Fitting, Special Tool 6844, on Pressure Hose, Special Tool 6713.
- Install Adapter Fitting, Special Tool 6826, on Pressure Hose, Special Tool 6959.

(2) Disconnect the power steering fluid pressure hose from the power steering pump (Fig. 5).

**DIAGNOSIS AND TESTING (Continued)****Fig. 4 Power Steering Analyzer Adapters 6893****Fig. 5 Power Steering Pump Pressure Hose**

- 1 - POWER STEERING PUMP  
2 - POWER STEERING PUMP PRESSURE HOSE

(3) Connect Adapter Fitting, Special Tool 6844, attached to pressure hose from inlet (gauge end) of Power Steering Analyzer to the pressure fitting on the power steering pump.

(4) Connect vehicle power steering fluid pressure hose to Adapter Fitting, Special Tool 6826, which should be already installed in the outlet hose (valve end) of Power Steering Analyzer.

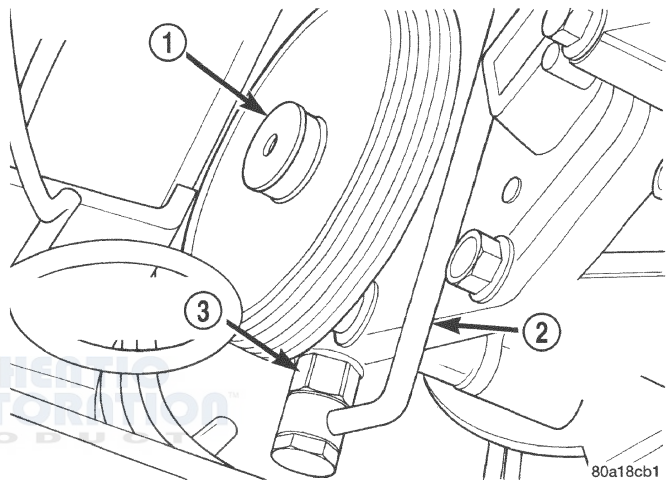
(5) Follow the test procedure listed after **VEHICLES WITH VARIABLE-ASSIST POWER STEERING**.

**VEHICLES WITH VARIABLE-ASSIST POWER STEERING**

Install the following adapters from Adapter Set, Special Tool 6893, and Special Tool 8354, on the analyzer hose ends:

- Install Adapter Fitting (Banjo Fitting), Special Tool 6866, on Pressure Hose and Adapter Fitting, Special Tool 6713.
- Install the Adapter Fitting Quick Connect for Special Tool 6972 on Pressure Hose, Special Tool 6959.

(1) Disconnect the power steering fluid pressure hose from the power steering pump (Fig. 6).

**Fig. 6 Power Steering Pump Pressure Hose**

- 1 - POWER STEERING PUMP  
2 - POWER STEERING PRESSURE HOSE  
3 - FLOW CONTROL VALVE FITTING

(2) Install Adapter, Special Tool 6972-1 in the pressure fitting on the power steering pump. Install Adapter Fitting Banjo Fitting, Special Tool 6866, attached to the analyzer, on Special Tool 6972-1. Install the supplied nut and tighten.

(3) Attach Adapter, Special Tool 8354, to the banjo fitting on the power steering fluid pressure hose. Connect the Adapter Fitting Quick Connect for Special Tool 6972 (attached to the analyzer) onto Special Tool 8354.

(4) Follow the test procedure below.

**TEST PROCEDURE**

- (1) Check belt tension and adjust as necessary.
- (2) Completely open valve on Power Steering Analyzer.
- (3) Start engine and let idle long enough to circulate power steering fluid through the analyzer and hoses, until the air is completely bled out of the fluid. Shut off engine.



## DIAGNOSIS AND TESTING (Continued)

(4) Check power steering fluid level and add fluid as necessary. Start engine again and let idle.

(5) The analyzer gauge should read below 862 kPa (125 psi). If above, inspect the hoses for restrictions and repair as necessary. The initial pressure should be in the range of 345-552 kPa (50-80 psi). The flow meter should read between 1.3 and 1.6 GPM.

**CAUTION:** The following test procedure involves testing maximum pump pressure output and flow control valve operation. Do not leave valve closed for more than five seconds as the pump could be damaged.

(6) Close valve fully three times and record highest pressure indicated each time. **All three readings must be above specifications and within 345 kPa (50 psi) of each other.**

**NOTE:** Power steering pump maximum relief pressure is 8240 to 8920 kPa (1195 to 1293 psi).

- Power steering pump pressure's are above specifications, but not within 345 kPa (50 psi) of each other, replace pump.

- Pressure's are within 345 kPa (50 psi) of each other, but below specifications, replace pump.

**CAUTION:** Do not force the pump to operate against the stops for more than 2 to 4 seconds at a time because pump damage will result.

(7) Completely open the valve on the Power Steering Analyzer. Turn the steering wheel to the extreme left until the stop in the steering gear is met, then turn the steering wheel to the right until the right stop is met. Record the highest indicated pressure at each position. Compare the recorded readings to the specifications. If the highest output pressures are not the same against either stop, the steering gear is leaking internally and must be replaced.

## SERVICE PROCEDURES

### POWER STEERING FLUID LEVEL CHECK

**WARNING:** FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING PARTS.

**CAUTION:** Do not use automatic transmission fluid in the power steering system.

before removing the power steering filler cap, wipe the reservoir filler cap free of dirt and debris. Remove the cap and check the fluid level on its dip-

stick. The dipstick should indicate COLD when the fluid is at normal ambient temperature, approximately 21°C to 27°C (70°F to 80°F). Do not overfill the power steering system. Use only Mopar Power Steering Fluid, or an equivalent.

## REMOVAL AND INSTALLATION

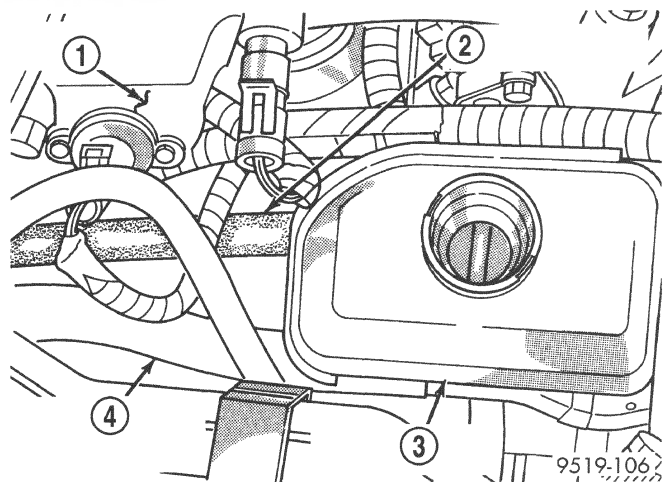
### POWER STEERING FLUID SUPPLY HOSE (2.5L ENGINE)

#### REMOVAL

(1) Using a siphon pump, remove as much power steering fluid as possible from the remote power steering fluid reservoir.

**CAUTION:** Care must be used when removing the power steering fluid supply hose from power steering fluid reservoir. If excessive force is used when trying to remove hose from nipple on power steering fluid reservoir, nipple can break off of the reservoir.

(2) Remove hose clamp, attaching power steering fluid supply hose to the power steering fluid reservoir. Then remove power steering fluid supply hose from power steering fluid reservoir (Fig. 7).



**Fig. 7 Power Steering Fluid Supply Hose At Reservoir**

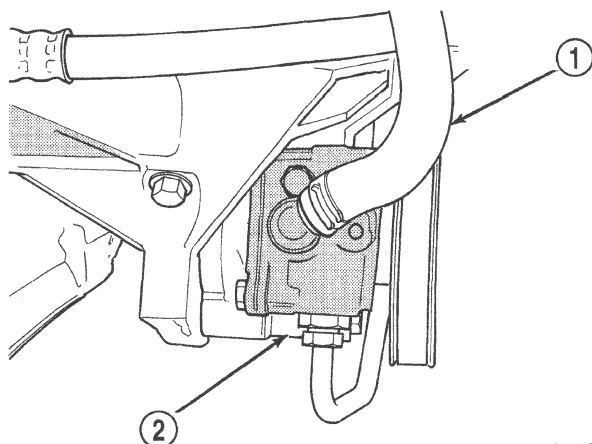
- 1 - INTAKE MANIFOLD
- 2 - POWER STEERING FLUID RETURN HOSE
- 3 - POWER STEERING FLUID RESERVOIR
- 4 - POWER STEERING FLUID SUPPLY HOSE (TO PUMP)

(3) Raise vehicle.

(4) Remove hose clamp, attaching power steering fluid supply hose to the power steering pump. Then remove power steering fluid supply hose from power steering pump fitting (Fig. 8).



## REMOVAL AND INSTALLATION (Continued)



9519-157

**Fig. 8 Fluid Supply Hose At Power Steering Pump**

- 1 - POWER STEERING FLUID SUPPLY HOSE  
2 - POWER STEERING PUMP

## INSTALLATION

(1) Install power steering fluid supply hose on power steering pump fitting, making sure it is correctly routed up to the power steering fluid reservoir. Install hose clamp on power steering fluid supply hose at power steering pump fitting (Fig. 8). **Be sure hose clamp is installed on power steering fluid supply hose past upset bead on power steering pump fitting.**

(2) Lower vehicle.

**CAUTION:** Care must be used when installing power steering fluid supply hose on power steering fluid reservoir. If excessive force is used when trying to install hose on nipple of power steering fluid reservoir, nipple can be broken off the reservoir.

(3) Install power steering fluid supply hose on power steering fluid reservoir fitting (Fig. 7). Install hose clamp on power steering fluid supply hose at power steering fluid reservoir. **Be sure hose clamp is installed on return hose past upset bead on power steering fluid reservoir.**

**CAUTION:** Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

- (4) Fill power steering fluid reservoir.
- (5) Start the engine and let run for a few seconds. Then turn the engine off.
- (6) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.
- (7) Raise front wheels of vehicle off the ground.

(8) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(9) Add power steering fluid if necessary.

(10) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(11) Stop the engine. Check the fluid level and refill as required.

(12) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(13) After hose is installed, check for leaks at all hose connections.

## POWER STEERING FLUID PRESSURE HOSE

Service all power steering hoses with the vehicle raised on a hoist. Cap all open ends of hoses, power steering pump fittings and steering gear ports to prevent the entry of foreign material into the components.

**WARNING: POWER STEERING FLUID, ENGINE PARTS AND EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.**

## REMOVAL

**NOTE:** To service the power steering pressure hose on this vehicle, the front suspension crossmember and steering gear will need to be lowered away from the body of the vehicle. This is required for access to the power steering hose connections on the side of the steering gear. Refer to the steering gear service procedure in this group of the service manual for the required procedure for removal of the front suspension crossmember.

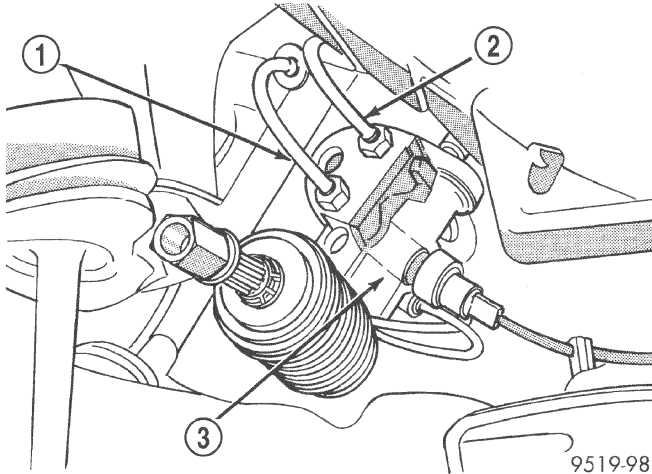
(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication And Maintenance section in this manual, for the required lifting procedure to be used for this vehicle.

**CAUTION:** When lowering the front suspension crossmember, its installed position on the vehicle's body must be marked on the crossmember before it is lowered. Use the procedure for the removal and replacement of the steering gear that is in this group of the service manual for the required procedure to locate and lower the crossmember.

## REMOVAL AND INSTALLATION (Continued)

(2) Lower the front suspension crossmember far enough to gain access to the high and low pressure ports on the steering gear.

(3) Disconnect the power steering pressure hose (Fig. 9) at the power steering gear. Drain power steering fluid from power steering pump and hose through open end of hose.



**Fig. 9 Power Steering Hose Connections At Steering Gear**

- 1 - POWER STEERING PRESSURE HOSE
- 2 - POWER STEERING RETURN HOSE
- 3 - POWER STEERING GEAR

(4) Remove the 2 routing brackets (Fig. 10) attaching the power steering return hose to the power steering pressure hose routing brackets. Then remove the 2 bolts attaching the power steering pressure hose routing brackets to the cylinder head (Fig. 10).

(5) Remove the power steering pressure hose from the pressure fitting on power steering pump (Fig. 11).

(6) Remove the power steering fluid pressure hose from the vehicle through the bottom rear of the engine compartment.

(7) Discard all used O-rings located at ends of power steering pressure hose fittings.

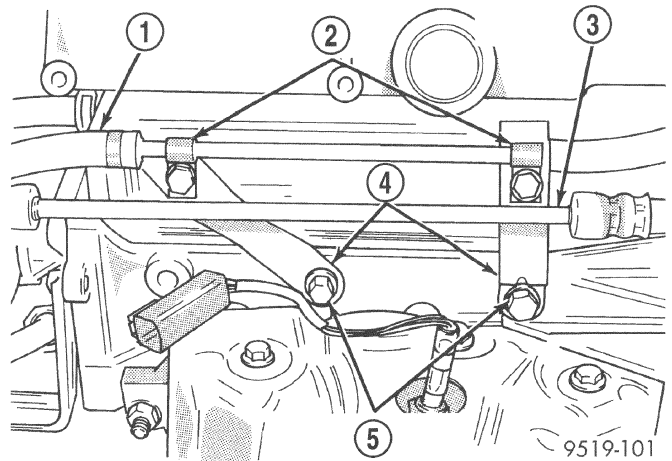
## INSTALLATION

(1) Install power steering pressure hose in vehicle from bottom of engine compartment using the reverse order of removal.

(2) Using a lint free towel, wipe clean all open power steering hose ends and the power steering pump and steering gear ports.

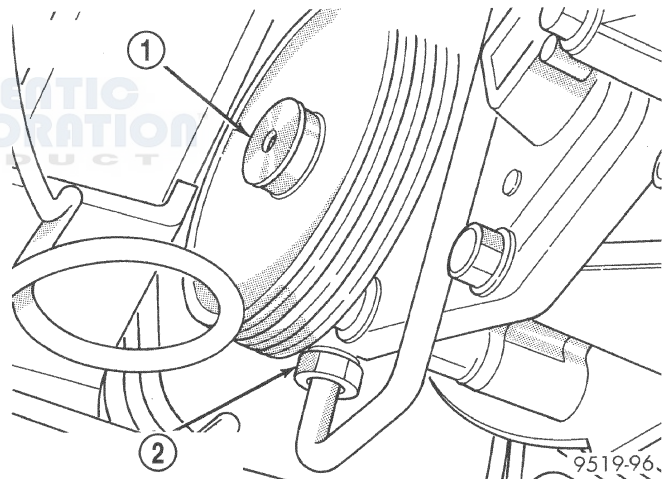
(3) Install new O-rings on the power steering pressure hose fittings. Lubricate O-rings using fresh clean power steering fluid.

(4) Attach the power steering pressure hose to outlet fitting on the power steering pump. **Do not tighten or torque pressure fitting at this time.**



**Fig. 10 2.5 Liter Power Steering Hose Routing**

- 1 - POWER STEERING RETURN HOSE
- 2 - ROUTING BRACKETS
- 3 - POWER STEERING PRESSURE HOSE
- 4 - ROUTING BRACKETS
- 5 - ROUTING BRACKET ATTACHING BOLTS



**Fig. 11 Power Steering Pump Pressure Fitting**

- 1 - POWER STEERING PUMP
- 2 - POWER STEERING PUMP PRESSURE HOSE

**CAUTION:** Hoses must remain away from exhaust system, vehicle components and unfriendly surfaces causing possible damage to power steering hoses.

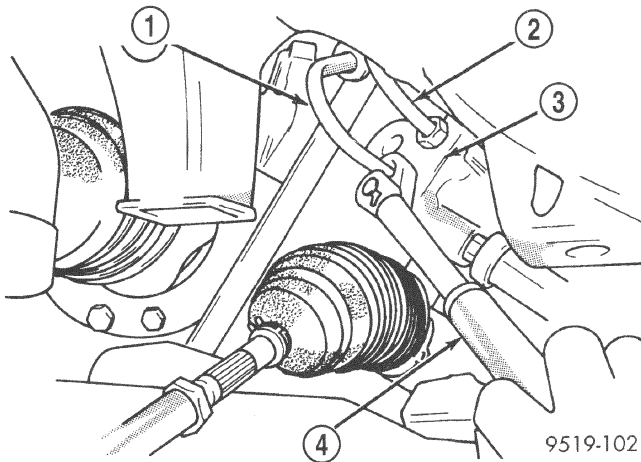
(5) Correctly route power steering pressure hose avoiding tight bends or kinking of the hose. Install power steering pressure hose routing brackets and attaching bolts on engine (Fig. 10).

(6) Route power steering pressure hose to pressure port on power steering gear. Install power steering pressure hose, on steering gear and loosely install tube nut into steering gear. Then using a crow foot,



**REMOVAL AND INSTALLATION (Continued)**

(Fig. 12) tighten the power steering pressure hose tube nut to a torque of 31 N·m (275 in. lbs.).



**Fig. 12 Power Steering Pressure Hose Tube Nut**

- 1 - POWER STEERING PRESSURE HOSE
- 2 - POWER STEERING RETURN HOSE
- 3 - STEERING GEAR
- 4 - TORQUE WRENCH

**CAUTION:** When installing the front suspension crossmember, it must be installed back in the same location on the vehicle's body as when it was originally installed when the vehicle was built. Use procedure for installing the steering gear that is in this group of the service manual for the required procedure to install and locate crossmember.

(7) Raise the front suspension crossmember and steering gear back up into the vehicle. Refer to the steering gear service procedure in this group of the service manual for the required procedure to install the front suspension crossmember.

(8) Lower the vehicle.

(9) Start the engine and let run for a few seconds, then turn the engine off.

(10) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(11) Raise front wheels of vehicle off the ground.

(12) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(13) Add power steering fluid if necessary.

(14) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(15) Stop the engine. Check the fluid level and refill as required.

(16) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(17) After hose is installed, check for leaks at all hose connections.

**POWER STEERING FLUID RETURN HOSE**

Service all power steering hoses with the vehicle raised on a hoist. Cap all open ends of hoses, power steering pump fittings and steering gear ports to prevent the entry of foreign material into the components.

**WARNING:** POWER STEERING FLUID, ENGINE PARTS AND EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES. DO NOT ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.

**REMOVAL**

**NOTE:** To remove the power steering return hose on this vehicle, the front suspension crossmember and steering gear will need to be lowered away from the body of the vehicle. This is required for access to the power steering hose connections on the side of the steering gear. Refer to the steering gear service procedure in this group of the service manual for the required procedure to remove the front suspension crossmember.

(1) Siphon all power steering fluid from the power steering fluid reservoir.

**CAUTION:** Care must be used when removing power steering fluid return hose from power steering fluid reservoir. If excessive force is used when trying to remove hose from nipple on power steering fluid reservoir, nipple can break off of the reservoir.

(2) Remove power steering fluid return hose from nipple on power steering fluid reservoir (Fig. 13).

(3) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication And Maintenance section in this manual, for the required lifting procedure to be used for this vehicle.

**CAUTION:** When lowering the front suspension crossmember, its installed position on the vehicle's body must be marked on the crossmember before it is lowered. Use procedure for the removal and replacement of the steering gear that is in this group of the service manual for the required procedure to locate and lower crossmember.

(4) Lower the front suspension crossmember far enough to gain access to the high and low pressure ports on the steering gear.

## REMOVAL AND INSTALLATION (Continued)

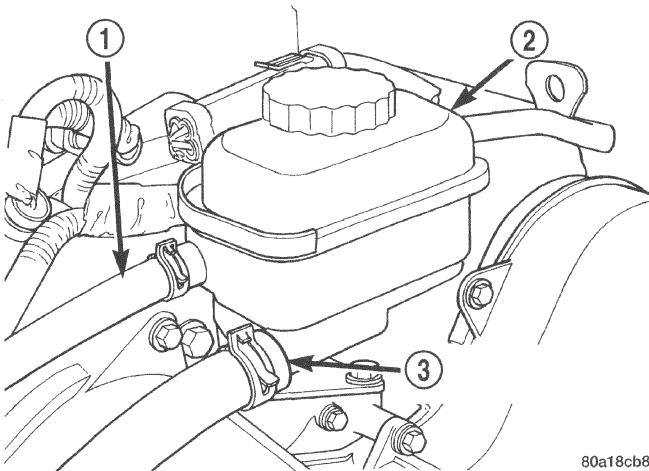


Fig. 13 Fluid Return Hose At Reservoir

- 1 - POWER STEERING FLUID RETURN HOSE
- 2 - POWER STEERING FLUID RESERVOIR
- 3 - POWER STEERING FLUID SUPPLY HOSE

(5) Disconnect power steering fluid return hose at power steering cooler line (Fig. 14). Drain power steering fluid from hose.

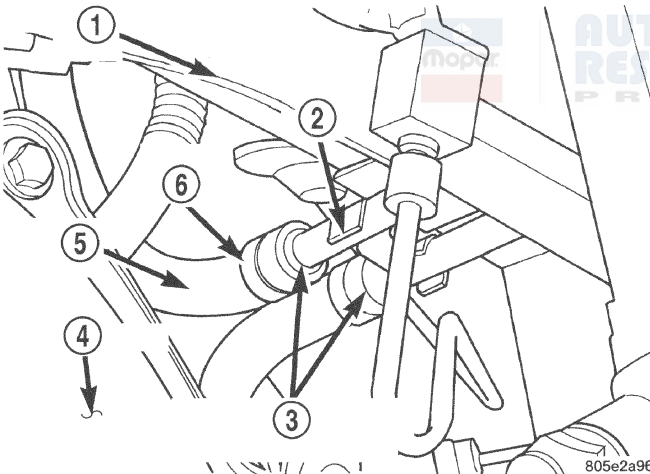


Fig. 14 Power Steering Hose Connections At Cooler Lines

- 1 - LEFT FRAME RAIL
- 2 - CLIP
- 3 - POWER STEERING COOLER LINES
- 4 - TRANSAXLE
- 5 - RETURN HOSE
- 6 - HOSE CLAMP

(6) Remove the 2 routing brackets (Fig. 15) attaching the power steering return hose to the power steering pressure hose routing brackets.

(7) Remove the power steering return hose from the vehicle. The power steering return hose is removed from the bottom of the engine compartment.

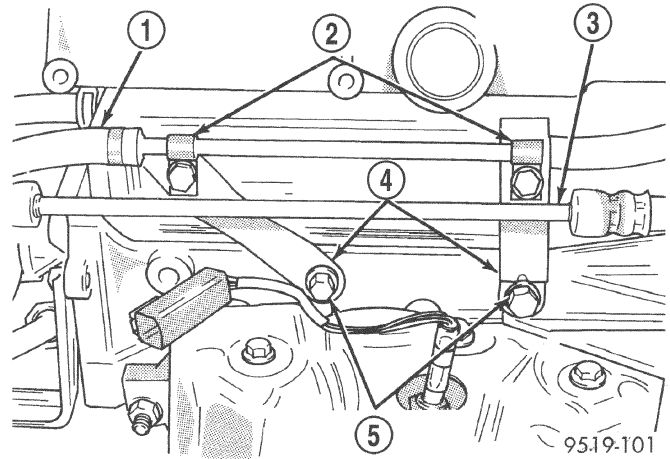


Fig. 15 2.5 Liter Power Steering Hose Routing

- 1 - POWER STEERING RETURN HOSE
- 2 - ROUTING BRACKETS
- 3 - POWER STEERING PRESSURE HOSE
- 4 - ROUTING BRACKETS
- 5 - ROUTING BRACKET ATTACHING BOLTS

## INSTALLATION

(1) Install power steering return hose on vehicle. Power steering return hose is installed from the bottom of the vehicle's engine compartment using the reverse steps of removal.

(2) Using a lint free towel, wipe clean all open power steering hose ends, and the power steering gear port.

(3) Install a new O-ring on the power steering return hose to steering gear fitting.

(4) Lubricate O-ring using fresh clean power steering fluid.

(5) Install the power steering return hose, on the cooler lines (Fig. 14).

**CAUTION:** Hoses must remain away from exhaust system, vehicle components and unfriendly surfaces causing possible damage to power steering hoses.

(6) Correctly route power steering return hose up to the power steering fluid reservoir, avoiding tight bends or kinking of the hose.

(7) Install the 2 routing brackets (Fig. 15) attaching the power steering return hose to the power steering pressure hose routing brackets.

**CAUTION:** When installing the front suspension crossmember, it must be installed back in the same location on the vehicle's body as when it was originally installed when the vehicle was built. Use procedure for installing the steering gear that is in this group of the service manual for the required procedure to install and locate crossmember.



**REMOVAL AND INSTALLATION (Continued)**

(8) Raise the front suspension crossmember and steering gear back up into the vehicle. Refer to the steering gear service procedure in this group of the service manual for the required procedure to install the front suspension crossmember.

(9) Lower the vehicle.

**CAUTION:** Care must be used when installing power steering fluid return hose on power steering fluid reservoir. If excessive force is used when trying to install hose on nipple of power steering fluid reservoir, nipple can be broken off the reservoir.

(10) Install power steering return hose on power steering fluid reservoir fitting. Install hose clamp on power steering return hose at power steering fluid reservoir (Fig. 13). **Be sure hose clamp is installed on return hose past upset bead on power steering fluid reservoir.**

(11) Start the engine and let run for a few seconds. Then turn the engine off.

(12) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(13) Raise front wheels of vehicle off the ground.

(14) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(15) Add power steering fluid if necessary.

(16) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(17) Stop the engine. Check the fluid level and refill as required.

(18) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(19) After hose is installed, check for leaks at all hose connections.

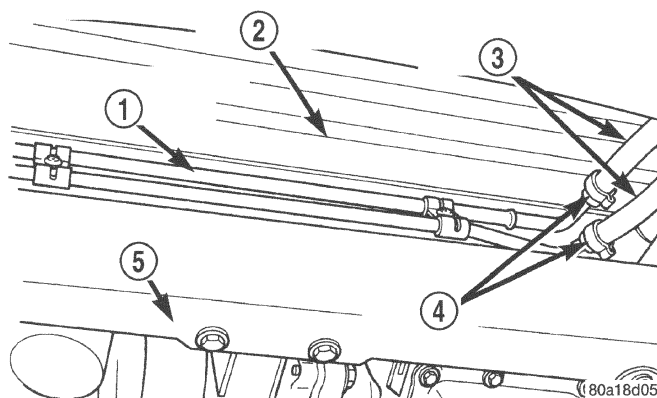
**POWER STEERING FLUID COOLER****REMOVAL**

(1) Raise vehicle using a frame contact type hoist or supported as required using jack stands. See Hoisting in the Lubrication And Maintenance group of this service manual for the required hoisting or jacking procedure to be used for this vehicle.

(2) Remove the hose clamps (Fig. 16) from the power steering fluid hoses. Drain power steering fluid from the hoses and the power steering fluid cooler.

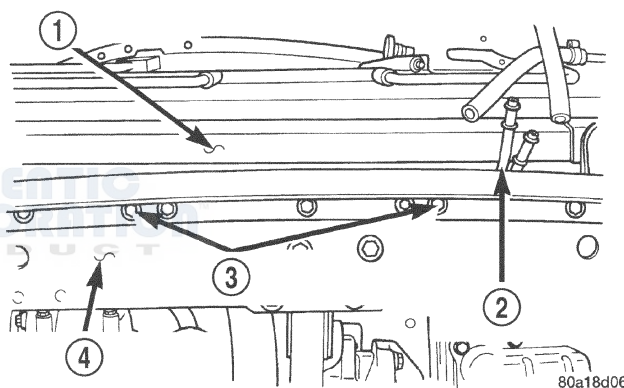
(3) Remove the 2 bolts (Fig. 17) attaching the power steering fluid cooler to the radiator lower crossmember (Fig. 17).

(4) Remove the power steering fluid cooler and mounting brackets as an assembly (Fig. 16) from the radiator lower crossmember. It is removed by rolling



**Fig. 16 Hose Clamps At Power Steering Fluid Cooler**

- 1 - POWER STEERING OIL COOLER
- 2 - RADIATOR
- 3 - POWER STEERING FLUID HOSES
- 4 - HOSE CLAMPS
- 5 - RADIATOR LOWER CROSSMEMBER



**Fig. 17 Power Steering Fluid Cooler Attachment**

- 1 - RADIATOR
- 2 - POWER STEERING OIL COOLER
- 3 - OIL COOLER ATTACHING BOLTS
- 4 - RADIATOR LOWER CROSSMEMBER

the bottom of the power steering fluid cooler and mounting brackets upward removing the tabs on the brackets from the radiator lower crossmember.

**INSTALLATION**

(1) Install tabs on mounting brackets into the holes in the radiator lower crossmember. Then rotate cooler upward into position on crossmember.

(2) Install the 2 bolts (Fig. 17) attaching the power steering fluid cooler to the radiator lower crossmember. Tighten the attaching bolt to a torque of 7 N·m (60 in. lbs.).

## REMOVAL AND INSTALLATION (Continued)

**CAUTION:** Only the original equipment crimp style clamp can be used when installing the power steering fluid hoses on the power steering oil cooler. Use of a different style clamp may not provide proper retention of the hose to the power steering oil cooler. Refer to the Mopar Parts Catalog for the required replacement hose clamp.

(3) Install the hose clamps on the power steering fluid hoses.

(4) Install power steering fluid hoses on the power steering fluid cooler. (Fig. 16). **Be sure hose clamps are installed on hose past the upset bead on the power steering oil cooler.**

(5) Using Crimper, Hose Clamp, Special Tool C-4124 properly crimp the clamps on the power steering fluid hoses at the power steering oil cooler.

(6) Lower the vehicle to a point where front tires are just off the ground.

(7) Start the engine and let run for a few seconds. Then turn the engine off.

(8) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(9) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.

(10) Add power steering fluid if necessary.

(11) Stop the engine. Check the fluid level and refill as required.

(12) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

## POWER STEERING FLUID COOLER LINES

### REMOVAL

(1) Secure the steering wheel in the STRAIGHT AHEAD position using a steering wheel holding tool.

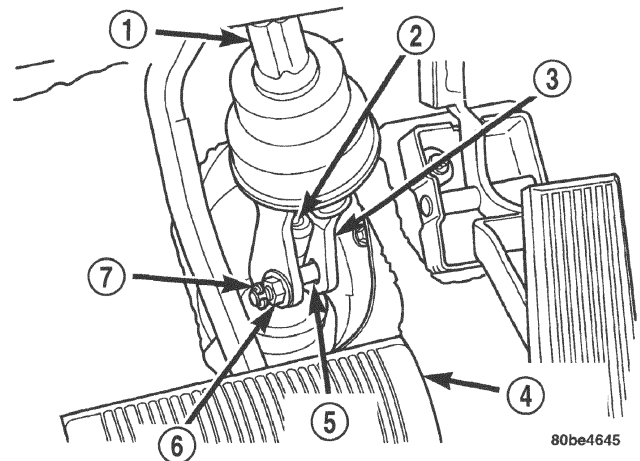
(2) Under the instrument panel, disconnect the intermediate shaft from the steering gear shaft. To do so, perform one of the following that applies:

(a) On early production vehicles, remove the "E" clip from the steering column intermediate shaft coupler pinch bolt (Fig. 18). Next, remove the pinch bolt from the intermediate shaft coupler by backing off the nut, then separate the intermediate shaft from steering gear shaft.

(b) On later production vehicles, remove the pinch bolt from the intermediate shaft coupler (Fig. 19), then slide the intermediate shaft up and off the steering gear shaft.

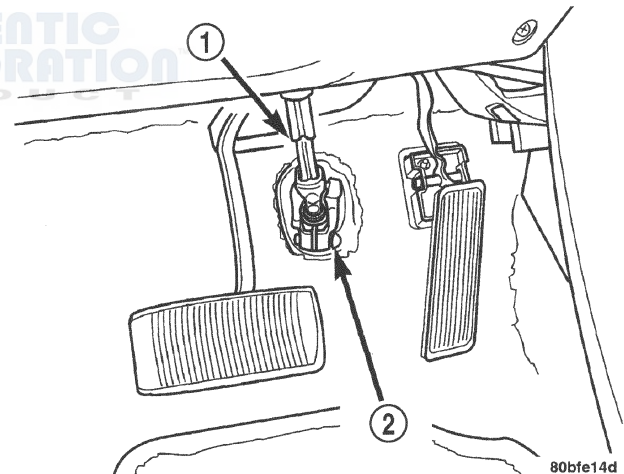
(3) Siphon as much power steering fluid as possible from the power steering fluid reservoir.

(4) Raise the vehicle using a frame contact type hoist or supported as required using jack stands. See Hoisting in the Lubrication and Maintenance group



**Fig. 18 Early Intermediate Shaft Attachment**

- 1 - INTERMEDIATE SHAFT
- 2 - STEERING GEAR SHAFT
- 3 - COUPLER
- 4 - BRAKE PEDAL
- 5 - PINCH BOLT
- 6 - NUT
- 7 - "E" CLIP



**Fig. 19 Later Intermediate Shaft Attachment**

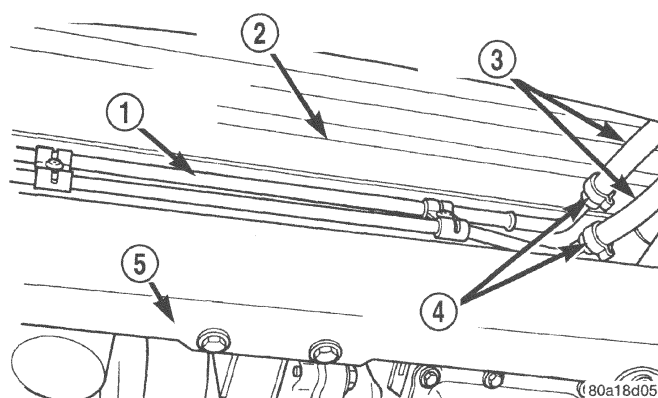
- 1 - INTERMEDIATE SHAFT
- 2 - PINCH BOLT

of this service manual for the required hoisting or jacking procedure to be used for this vehicle.

(5) Remove the left front wheel/tire.

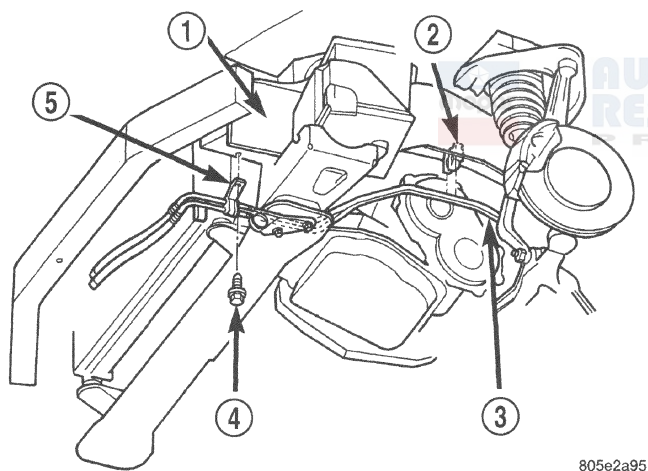
(6) Remove the front fascia and the grill as an assembly from the vehicle. Refer to Front Bumper/Fascia in Group 13 of this service manual for the proper procedure.

(7) Remove the hose clamps (Fig. 20) from the power steering fluid hoses. Drain power steering fluid from the hoses and the power steering fluid cooler.

**REMOVAL AND INSTALLATION (Continued)****Fig. 20 Hose Clamps At Power Steering Fluid Cooler**

- 1 - POWER STEERING OIL COOLER
- 2 - RADIATOR
- 3 - POWER STEERING FLUID HOSES
- 4 - HOSE CLAMPS
- 5 - RADIATOR LOWER CROSSMEMBER

(8) Remove the bracket attaching the power steering fluid cooler lines to the left front frame rail (Fig. 21).

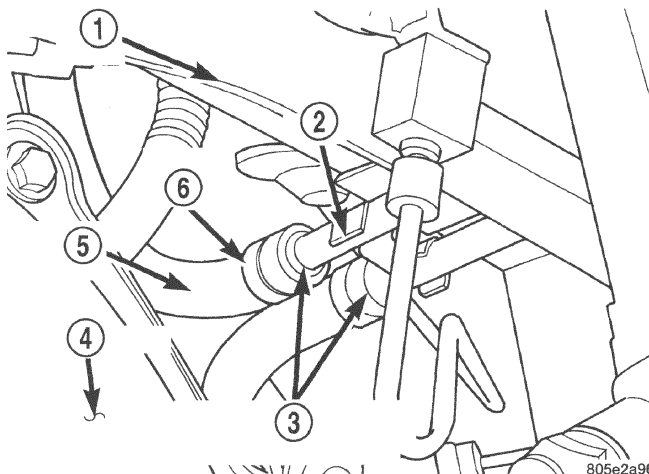
**Fig. 21 Power Steering Cooler Line Attachment**

- 1 - LEFT FRAME RAIL
- 2 - ROUTING CLIP
- 3 - POWER STEERING FLUID COOLER LINES
- 4 - BOLT
- 5 - BRACKET

(9) Lower the front suspension crossmember. Refer to the steering gear service procedures in this group of the service manual for the required procedure for the removal of the front suspension crossmember.

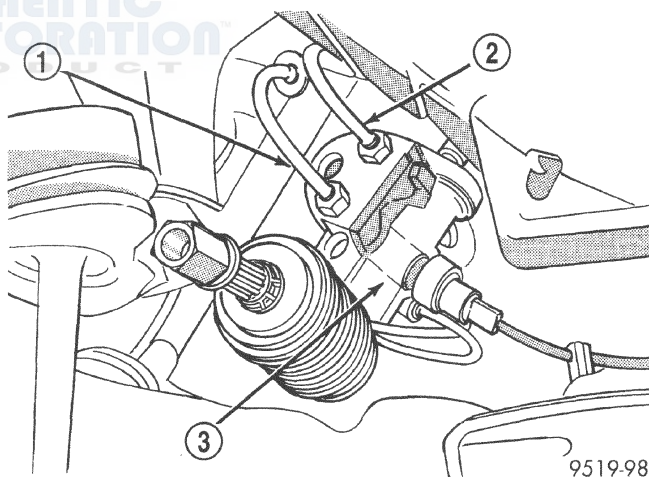
(10) Remove the clip (Fig. 22) holding the power steering fluid cooler lines together.

(11) Remove the hose clamp (Fig. 22) attaching the power steering fluid return hose from the engine, (Fig. 22) to the power steering fluid cooler lines.

**Fig. 22 Power Steering Cooler Line Clip**

- 1 - LEFT FRAME RAIL
- 2 - CLIP
- 3 - POWER STEERING COOLER LINES
- 4 - TRANSAXLE
- 5 - RETURN HOSE
- 6 - HOSE CLAMP

(12) Remove the power steering fluid return hose (Fig. 23) from the power steering gear.

**Fig. 23 Power Steering Hose Connections At Steering Gear**

- 1 - POWER STEERING PRESSURE HOSE
- 2 - POWER STEERING RETURN HOSE
- 3 - POWER STEERING GEAR

(13) Remove the power steering fluid cooler lines from the routing clip on the left front frame rail (Fig. 21).

(14) Separate the power steering cooler line assembly into 2 separate pieces.

(15) Remove each cooler line separately from the vehicle. The cooler lines are removed out through the front of the vehicle in the area between the radiator and the closure panel.



## REMOVAL AND INSTALLATION (Continued)

### INSTALLATION

(1) Install the cooler lines individually using the reverse procedure of their removal.

(2) Install the cooler lines in the routing clip on the left frame rail

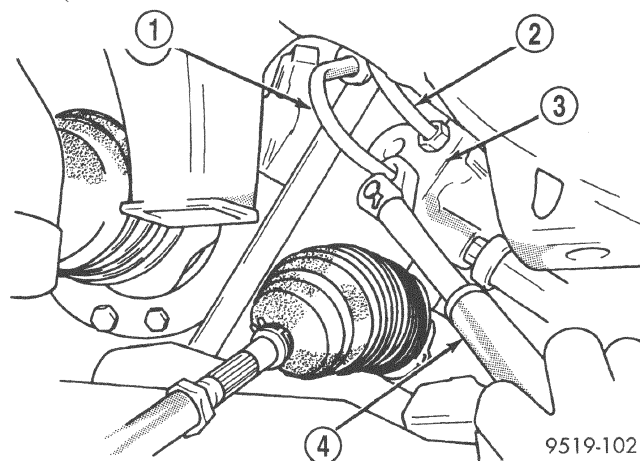
**CAUTION:** Only the original equipment crimp style clamp can be used when installing the power steering fluid hoses. Use of a different style clamp may not provide proper retention of the hose to the power steering oil cooler. Refer to the Mopar Parts Catalog for the required replacement hose clamp.

(3) Install the hose clamps on the power steering fluid hoses.

(4) Install the power steering fluid return hose coming from the engine on the power steering cooler line (Fig. 22). **Be sure hose clamp is installed on hose past the upset bead on the power steering cooler line.**

(5) Using Crimper, Hose Clamp, Special Tool C-4124 properly crimp the clamps on the power steering fluid hoses at the power steering oil cooler line.

(6) Install the power steering fluid return hose on the steering gear. Then using a crow foot and torque wrench (Fig. 24) tighten the tube nut to a torque of 31 N·m (275 in. lbs.).



**Fig. 24 Torquing Power Steering Fluid Hose Tube Nuts**

- 1 - POWER STEERING PRESSURE HOSE
- 2 - POWER STEERING RETURN HOSE
- 3 - STEERING GEAR
- 4 - TORQUE WRENCH

(7) Install the clip (Fig. 22) holding the 2 power steering fluid cooler lines together.

(8) Install the front suspension crossmember. Refer to the steering gear service procedures in this group

of the service manual for the required procedure for the installation of the front suspension crossmember.

(9) Install the left front wheel/tire.

(10) Install the bracket attaching the power steering cooler lines to the left frame rail (Fig. 21). Install bracket attaching bolt and tighten to a torque of 7 N·m (60 in. lbs.).

**CAUTION:** Only the original equipment crimp style clamp can be used when installing the power steering fluid hoses on the power steering fluid cooler. Use of a different style clamp may not provide proper retention of the hose to the power steering fluid cooler. Refer to the Mopar Parts Catalog for the required replacement hose clamp.

(11) Install the hose clamps on the power steering fluid hoses.

(12) Install power steering fluid hoses on the power steering fluid cooler. (Fig. 20). **Be sure hose clamps are installed on hose past the upset bead on the power steering fluid cooler.**

(13) Using Crimper, Hose Clamp, Special Tool C-4124 properly crimp the clamps on the power steering fluid hoses at the power steering fluid cooler.

(14) Install the front fascia and grill on the vehicle. Refer to Front Bumper/Fascia in Group 13 of this service manual for the proper procedure.

(15) Lower the vehicle to a point where front tires are just off the ground.

(16) Under the instrument panel, reconnect the intermediate shaft to the steering gear shaft. To do so, perform one of the following that applies:

(a) On early production vehicles, reconnect the steering column intermediate shaft to the steering gear shaft (Fig. 18). Install a **new** intermediate shaft coupler pinch bolt through the coupler and into its nut, then tighten the nut and pinch bolt to a torque of 27 N·m (240 in. lbs.).

(b) On later production vehicles, align the flats and slide the intermediate shaft onto the steering gear shaft aligning the pinch bolt hole with the notch formed into the steering gear shaft. Install a **new** pinch bolt in the intermediate shaft coupler (Fig. 19), then tighten the pinch bolt to a torque of 34 N·m (300 in. lbs.).

(17) On early production vehicles, install a **new** "E" clip on the end of the pinch bolt (Fig. 18).

(18) Start the engine and let run for a few seconds, then turn the engine off.

(19) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(20) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.

(21) Add power steering fluid if necessary.



**REMOVAL AND INSTALLATION (Continued)**

(22) Stop the engine. Check the fluid level and refill as required.

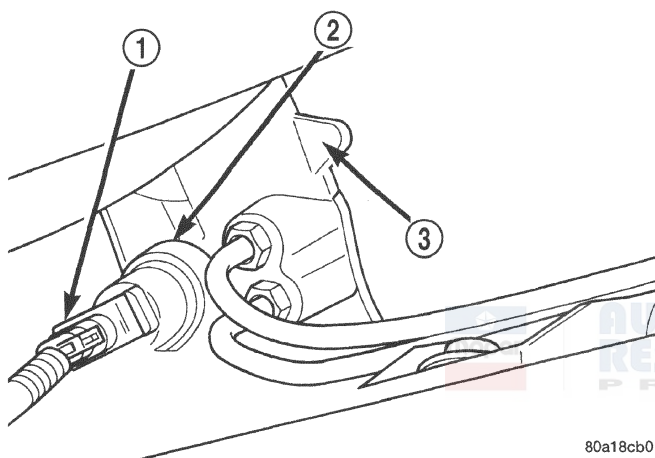
(23) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

**POWER STEERING FLUID PRESSURE SWITCH****REMOVE**

(1) Disconnect negative battery cable from the negative post of the battery. Be sure cable is isolated from negative post on battery.

(2) Raise vehicle.

(3) Locate power steering pressure switch (Fig. 25) on the back side of the power steering gear.



**Fig. 25 Power Steering Pressure Switch Location  
On Steering Gear**

1 - WIRING HARNESS CONNECTOR

2 - POWER STEERING PRESSURE SWITCH

3 - POWER STEERING GEAR

(4) Remove the vehicle's wiring harness connector (Fig. 25) from the power steering pressure switch.

(5) Using a crow foot and a long extension, remove the power steering pressure switch, from the power steering gear.

**INSTALL**

**CAUTION:** When tightening the power steering pressure switch after installation in steering gear, do not exceed the torque specification shown in step 1 below. Over-tightening may result in stripping the threads out of the pressure switch port on the steering gear.

(1) Install power steering pressure switch into power steering gear by hand until fully seated. Then using a crow foot and extension, tighten power steering pressure switch to a torque of 16 N·m (12 ft. lbs.).

(2) Install vehicle wiring harness connector onto power steering pressure switch. Be sure latch on wiring harness connector is fully engaged with locking tab on power steering pressure switch.

**CAUTION:** Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.

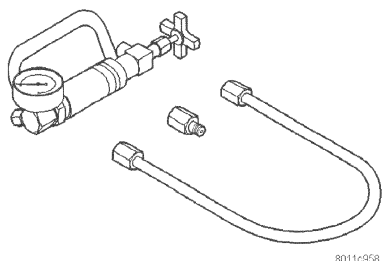
(3) Fill power steering reservoir to correct fluid level.

(4) Connect negative cable back on negative post of battery.

(5) Start engine and turn steering wheel several times from stop to stop to bleed air from fluid in system. Stop engine, check fluid level, and inspect system for leaks. See Checking Fluid Level.

**SPECIFICATIONS****POWER STEERING FASTENER TORQUE SPECIFICATIONS**

DESCRIPTION	TORQUE
<b>POWER STEERING PUMP:</b>	
Discharge Fitting . . . . .	75 N·m (55 ft. lbs.)
Rear Bracket Mounting Bolts . . . . .	54 N·m (40 ft. lbs.)
Front Bracket Mounting Bolts . . . . .	54 N·m (40 ft. lbs.)
Bracket To Engine Mounting Bolts . . . . .	54 N·m (40 ft. lbs.)
<b>POWER STEERING FLUID HOSES:</b>	
Hose Tube Nuts . . . . .	31 N·m (275 in. lbs.)
Return Hose Bracket To Head . . . . .	28 N·m (21 ft. lbs.)
Pressure Hose To Return Hose Bracket . . . . .	9 N·m (75 in. lbs.)
<b>POWER STEERING FLUID RESERVOIR:</b>	
Reservoir To Mounting Bracket Or Engine . . . . .	28 N·m (21 ft. lbs.)
Reservoir Bracket To Engine . . . . .	28 N·m (21 ft. lbs.)

**SPECIAL TOOLS****POWER STEERING**

***Power Steering Analyzer 6815***



**AUTHENTIC  
RESTORATION™  
PRODUCT**

## POWER STEERING PUMP

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## DESCRIPTION AND OPERATION

### POWER STEERING PUMP

#### DESCRIPTION

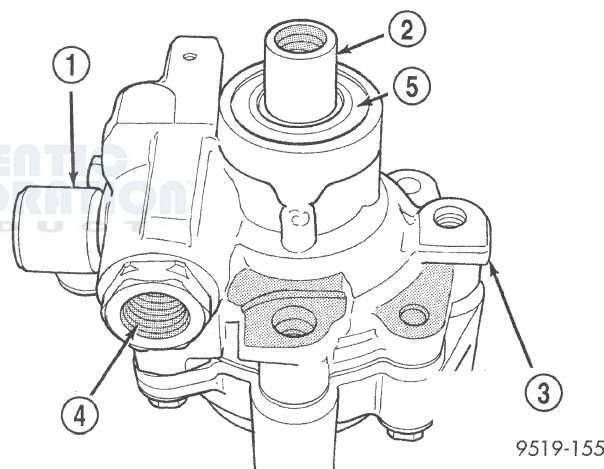
On all vehicles equipped with power steering, the hydraulic pressure for operation of the power steering gear is provided by a belt driven power steering pump (Fig. 1). It is mounted on the back side of the engine, above the front suspension crossmember.

Early production vehicles are equipped with variable-assist power steering pumps. Later production vehicles are equipped with standard power steering pumps only.

Vehicles that are equipped with variable-assist power steering use a droop flow style power steering pump. The droop flow power steering pump is a constant displacement vane type, but has a variable flow rate. This provides the speed-sensitive variable-assist power steering. The variable-assist power steering pump can be easily identified by the type of power steering fluid pressure hose fitting connection. While standard pumps use a standard tube fitting, variable-assist power steering pumps use a banjo style fitting (Fig. 2).

The power steering pump uses a remote mounted reservoir for storage of the power steering fluid.

Because of unique shaft bearings, flow control levels or pump displacements, power steering pumps may be used only on specific vehicle applications. Be sure that the power steering pump is only replaced with a pump that is the correct replacement for that specific application.



**Fig. 1 Power Steering Pump**

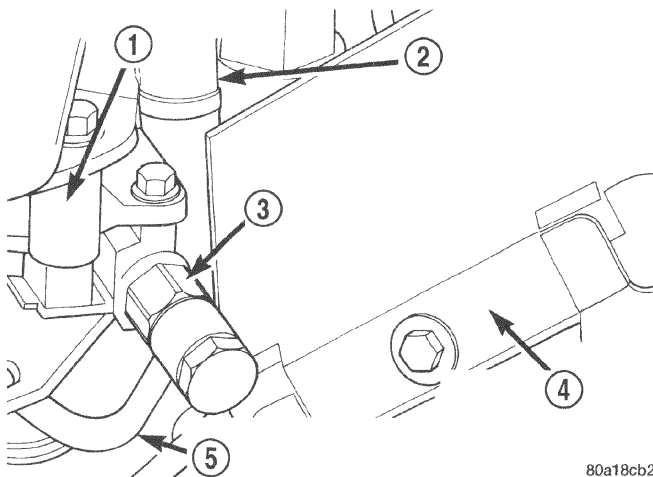
- 1 - POWER STEERING PUMP FLUID SUPPLY FITTING
- 2 - POWER STEERING PUMP SHAFT
- 3 - POWER STEERING PUMP HOUSING
- 4 - POWER STEERING PUMP DISCHARGE FITTING
- 5 - POWER STEERING PUMP SHAFT SEAL

#### OPERATION

Hydraulic pressure is provided for operation of the power steering gear by the belt driven power steering pump. The power steering pump is connected to the steering gear by a power steering fluid pressure hose, return hose, power steering fluid cooler and remote power steering fluid reservoir.

Rectangular pumping vanes in the shaft driven rotor move power steering fluid from the intake to the cam ring pressure cavities of the power steering pump. As the rotor begins to turn, centrifugal force throws the vanes against the inside surface of the cam ring to pick up residual fluid. This fluid is then

## DESCRIPTION AND OPERATION (Continued)



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**Fig. 2 Pressure Hose Fitting**

- 1 - POWER STEERING PUMP
- 2 - POWER STEERING FLUID SUPPLY HOSE
- 3 - FLOW CONTROL VALVE FITTING
- 4 - ABS HYDRAULIC CONTROL UNIT HEAT SHIELD
- 5 - POWER STEERING PRESSURE HOSE

forced into the high pressure area. As more fluid is picked up by the vanes, the additional fluid is forced into the cavities of the thrust plate through two crossover holes in the cam ring and pressure plate. The crossover holes empty into the high pressure area between the pressure plate and the housing end cover.

As the high pressure area is filled, fluid flows under the vanes in the rotor slots, forcing the vanes to follow the inside surface of the cam ring. As the vanes reach the restricted area of the cam ring, fluid is forced out from between the vanes. When excess fluid flow is generated during high-speed operation, a regulated amount of fluid returns to the pump intake side through a flow control valve. The flow control valve reduces the power required to drive the pump and holds down temperature build-up.

The speed-sensitive variable-assist power steering which is built into the early power steering pump provides full power steering assist at engine idle. As engine speed is increased, power assist is gradually reduced by varying the pump flow rate to provide a firm, responsive feel to the steering system at higher vehicle speeds.

When steering conditions exceed maximum pressure requirements, such as when the wheels are turned against the stops, the pressure built up in the steering gear exerts pressure on the spring end of the flow control valve inside the pump. The high pressure lifts the relief valve ball from its seat and allows fluid to flow through a trigger orifice located in the outlet fitting. This reduces pressure on the spring end of the flow control valve which then opens and

allows the fluid to return to the intake side of the pump. This action limits maximum pressure output of the power steering pump.

Under normal power steering pump operating conditions, pressure requirements of the pump are below maximum, causing the pressure relief valve to remain closed.

In the event of a power steering pump drive belt failure, manual steering control of the vehicle can still be maintained without pump assistance. However, under these conditions, steering effort will be significantly increased.

## POWER STEERING FLUID RESERVOIR

### DESCRIPTION

All vehicles equipped with power steering use a remote mounted reservoir for storage of the power steering fluid. The power steering fluid remote reservoir on the 2.5L engine is mounted to the front side of the engine above the drive belts, between the cylinder heads.

### OPERATION

The power steering fluid reservoir stores fluid for the power steering system.

## SERVICE PROCEDURES

### POWER STEERING PUMP INITIAL OPERATION

**CAUTION:** The fluid level should be checked with engine off to prevent injury from moving components. Use only Mopar® Power Steering Fluid. Do not use automatic transmission fluid. Do not over-fill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **FULL COLD** when the fluid is at normal temperature of approximately 21°C to 27°C (70°F to 80°F).

(1) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two (2) minutes.

(2) Start the engine and let run for a few seconds. Then turn the engine off.

(3) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(4) Raise the front wheels off the ground.

(5) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.

(6) Add power steering fluid if necessary.

(7) Lower the vehicle and turn the steering wheel slowly from lock to lock.



**SERVICE PROCEDURES (Continued)**

(8) Stop the engine. Check the fluid level and refill as required.

(9) If the fluid is extremely foamy, allow the vehicle to stabilize a few minutes, then repeat the above procedure.

**REMOVAL AND INSTALLATION****POWER STEERING PUMP  
(2.5L ENGINE - EARLY PRODUCTION)**

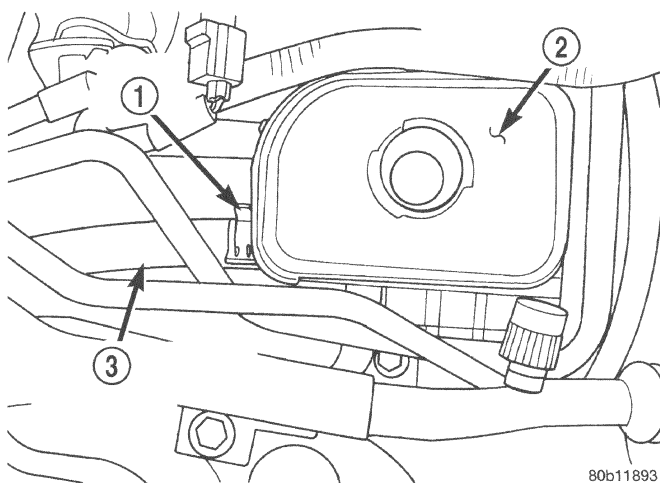
**WARNING: POWER STEERING FLUID, ENGINE COMPONENTS AND EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES, OR ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.**

**REMOVAL**

(1) Remove battery cable from (-) negative post on battery and isolate cable.

(2) Siphon as much power steering fluid as possible out of the remote power steering fluid reservoir.

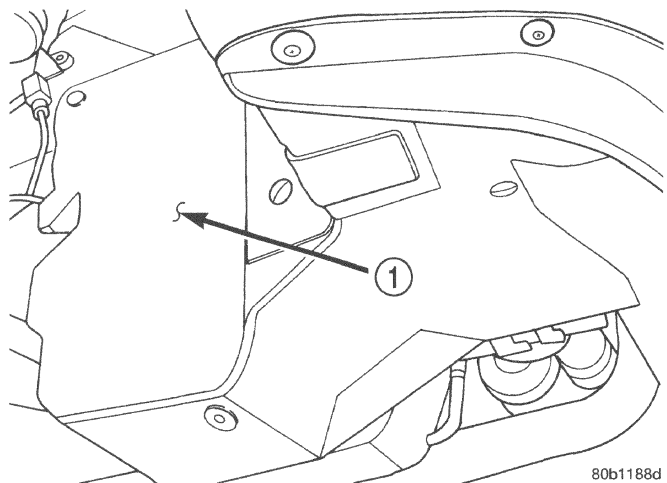
(3) Remove the power steering fluid supply hose from the power steering fluid reservoir (Fig. 3). Fluid supply hose will be removed with the power steering pump.



**Fig. 3 Supply Hose At Power Steering Fluid Reservoir**

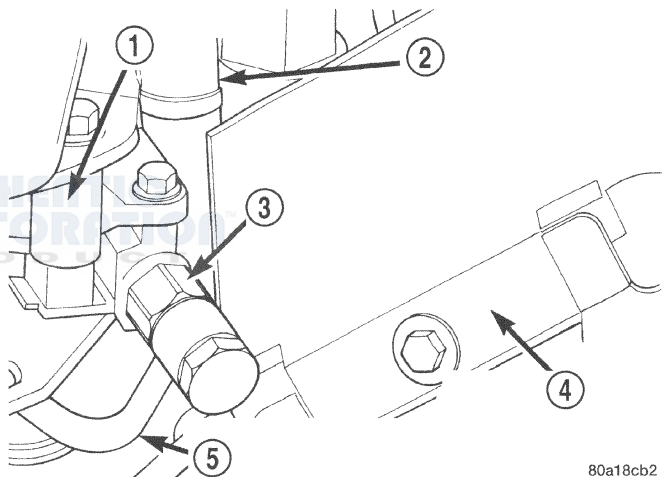
- 1 - HOSE CLAMP
- 2 - POWER STEERING FLUID RESERVOIR
- 3 - POWER STEERING FLUID SUPPLY HOSE

- (4) Raise vehicle.
- (5) Remove right front tire from vehicle.
- (6) Remove accessory drive splash shield (Fig. 4).
- (7) Remove the heat shield for the antilock brakes hydraulic control unit (Fig. 5).



**Fig. 4 Accessory Drive Splash Shield**

- 1 - SPLASH SHIELD



**Fig. 5 Heat Shield**

- 1 - POWER STEERING PUMP
- 2 - POWER STEERING FLUID SUPPLY HOSE
- 3 - FLOW CONTROL VALVE FITTING
- 4 - ABS HYDRAULIC CONTROL UNIT HEAT SHIELD
- 5 - POWER STEERING PRESSURE HOSE

(8) Loosen bolt at adjusting slot in accessory drive mounting bracket, (Fig. 6) attaching back of power steering pump to the bracket.

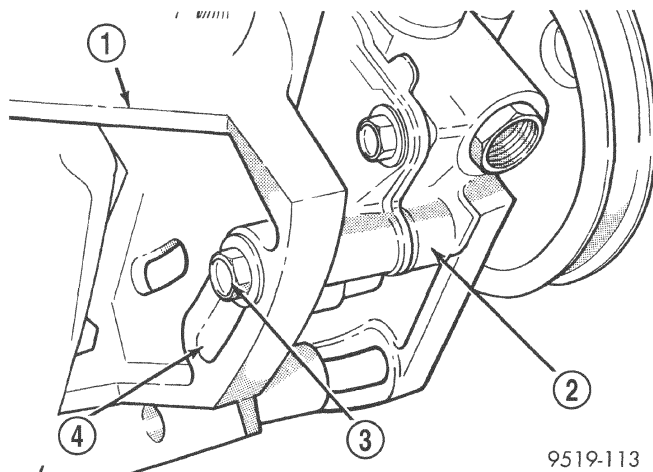
(9) Loosen bolt (Fig. 7) at top of power steering pump front mounting bracket, attaching it to the accessory drive bracket.

(10) Loosen bolt at adjustment slot, (Fig. 7) attaching the power steering pump front mounting bracket to cast aluminum accessory drive bracket on engine.

(11) Move the power steering pump toward the engine as far as possible.

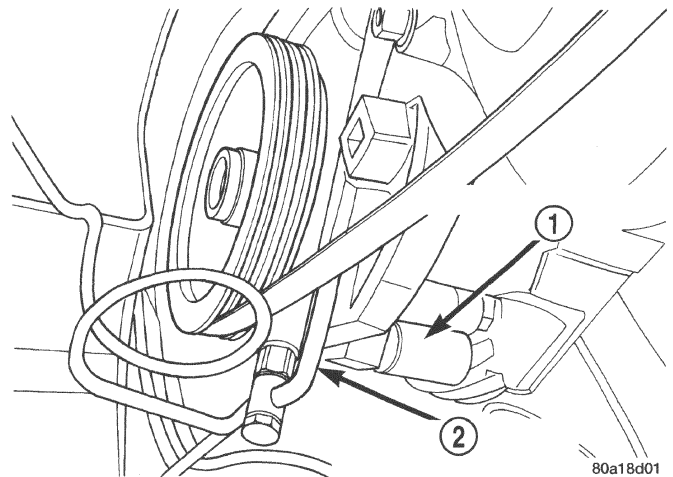
(12) Remove the power steering fluid pressure hose from pressure fitting on power steering pump (Fig. 8). Be careful not to loose the copper sealing

## REMOVAL AND INSTALLATION (Continued)



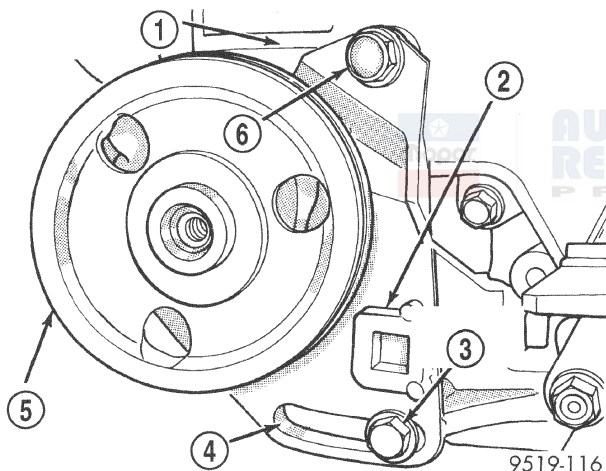
**Fig. 6 Power Steering Pump Rear Mounting Bolt**

- 1 - ACCESSORY DRIVE MOUNTING BRACKET
- 2 - POWER STEERING PUMP
- 3 - BOLT
- 4 - ADJUSTING SLOT



**Fig. 8 Power Steering Pressure Hose Attachment To Pump**

- 1 - POWER STEERING PUMP
- 2 - POWER STEERING PRESSURE HOSE



**Fig. 7 Power Steering Pump Front Bracket Attachment**

- 1 - ENGINE ACCESSORY DRIVE BRACKET
- 2 - POWER STEERING PUMP FRONT MOUNTING BRACKET
- 3 - BOLT
- 4 - ADJUSTING SLOT
- 5 - POWER STEERING PUMP
- 6 - BOLT

washers on both sides of the hose banjo fitting once the flow bolt is removed. Let the remaining power steering fluid drain out of the power steering fluid supply hose, power steering pump and power steering fluid pressure hose. **After power steering fluid has drained out of pump and hose, install a cap on the power steering pressure hose and a plug in the power steering pump pressure fitting.**

(13) Remove the power steering pump drive belt from power steering pump pulley.

(14) Remove bolt at adjusting slot in accessory drive mounting bracket, (Fig. 6) attaching back of power steering pump to the bracket.

(15) Remove bolt at adjustment slot, (Fig. 7) attaching the power steering pump front mounting bracket to cast aluminum accessory drive bracket on engine. Then remove bolt (Fig. 7) at top of power steering front mounting bracket, attaching it to the accessory drive bracket.

(16) Remove power steering pump, supply hose and its front mounting bracket as an assembly from the engine mounted power steering pump mounting bracket. Place the power steering pump on top of the antilock brakes hydraulic control unit.

**NOTE: The power steering pump can not be removed from the vehicle without first removing the power steering pump mounting bracket from the engine.**

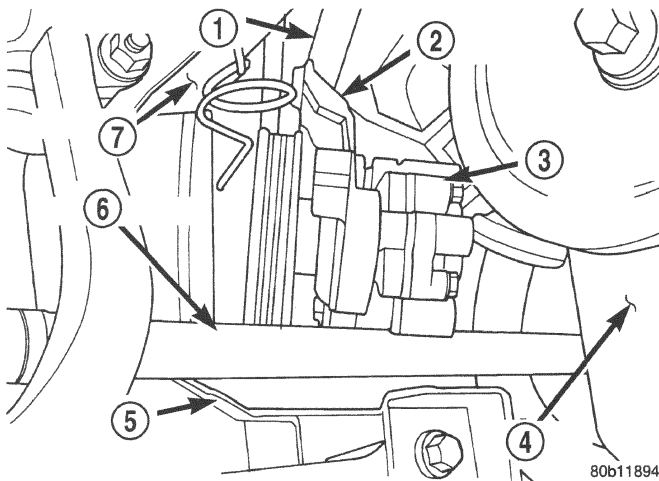
(17) Remove the 4 bolts mounting the power steering pump mounting bracket to the engine.

(18) Remove the power steering pump mounting bracket from the engine. Position the power steering pump mounting bracket where it will not be in the way when removing power steering pump from the vehicle.

(19) Remove power steering pump, fluid supply hose and front mounting bracket as an assembly from the engine and vehicle. Pump, fluid supply hose and mounting bracket is removable by bringing it out through area between rear of engine, frame drive-shaft and front suspension crossmember (Fig. 9).

(20) Transfer required parts from removed power steering pump, to replacement power steering pump.

## REMOVAL AND INSTALLATION (Continued)

**Fig. 9 Power Steering Pump Removal/Installation**

- 1 - SUPPLY HOSE
- 2 - MOUNTING BRACKET
- 3 - POWER STEERING PUMP
- 4 - ENGINE
- 5 - FRONT SUSPENSION CROSSMEMBER
- 6 - DRIVESHAFT
- 7 - FRAME

## INSTALLATION

(1) Install power steering pump, mounting bracket and fluid supply hose as an assembly back in vehicle, using the reverse of the removal procedure. **Be sure power steering fluid supply hose is correctly routed up to the power steering fluid reservoir when installing power steering pump.**

(2) Place the power steering pump on top of the antilock brakes hydraulic control unit.

(3) Install the power steering pump mounting bracket on the rear of the engine. Tighten the mounting bracket attaching bolts to a torque of 54 N·m (40 ft. lbs.).

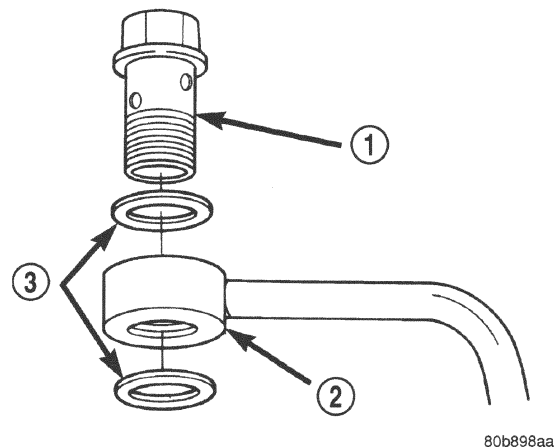
(4) Install power steering pump and front bracket on engine mounted power steering pump mounting bracket. Loosely install bolt at adjusting slot and top of power steering pump front bracket (Fig. 7) mounting pump bracket to accessory drive bracket.

(5) Loosely install the bolt mounting power steering pump to its rear mounting bracket (Fig. 6).

(6) Using a lint free towel, wipe clean all open power steering hose ends, and power steering pump fittings.

(7) Install a copper washer on each side of the power steering pressure hose banjo fitting, then install the flow bolt through the center (Fig. 10).

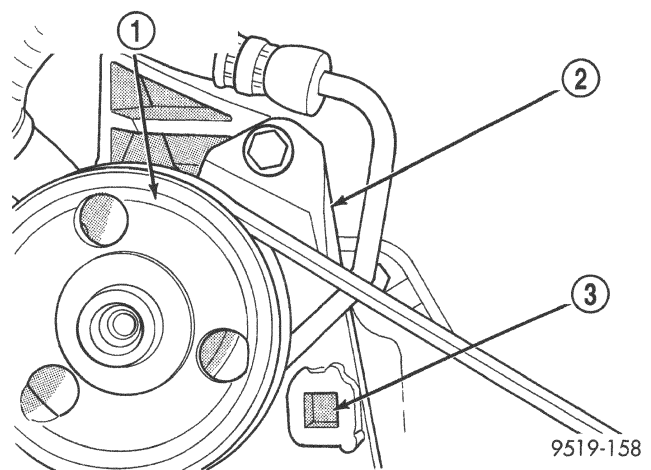
(8) Install the power steering pressure hose to the power steering pump pressure fitting. Loosely install the flow bolt into the power steering pump. **Pressure hose must be installed between the front bracket of the power steering pump and the back side of the power steering pump pulley.**

**Fig. 10 Pressure Fitting And Washers**

- 1 - FLOW BOLT
- 2 - FITTING
- 3 - COPPER WASHERS

(9) Install power steering pump drive belt on power steering pump pulley.

(10) Install a 1/2 in. breaker bar in the square adjusting hole in the front power steering pump mounting bracket (Fig. 11) Then rotate pump to obtain the correct drive belt tension. See Accessory Drive Belts in Group 7 Cooling System of this service manual for the correct drive belt tension specification. When correct drive belt tension is obtained first tighten the bottom 2 adjusting slot bolts at the power steering pump cast mounting bracket to a torque of 54 N·m (40 ft. lbs.). Then tighten the power steering pump mounting bracket top pivot bolt to a torque of 54 N·m (40 ft. lbs.).

**Fig. 11 Power Steering Pump Front Mounting Bracket Adjusting Hole**

- 1 - POWER STEERING PUMP
- 2 - POWER STEERING PUMP MOUNTING BRACKET
- 3 - ADJUSTING HOLE



## REMOVAL AND INSTALLATION (Continued)

(11) Position power steering pressure hose so hose is not contacting the power steering pump pulley or the drive belt. Tighten the banjo fitting flow bolt to a torque of 47 N·m (35 ft. lbs.).

(12) Install heat shield on hydraulic control unit (Fig. 5).

(13) Install accessory drive splash shield (Fig. 4).

(14) Install wheel and tire. Tighten the wheel lug nuts in proper sequence until all lug nuts are torqued to half specification. Then repeat tightening sequence to full specified torque of 129 N·m (95 ft. lbs.).

(15) Lower vehicle.

(16) Install power steering fluid supply hose (Fig. 3) on power steering fluid reservoir fitting. Install hose clamp on hose. Be sure hose clamp is installed on hose past upset bead on power steering fluid reservoir.

**CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.**

(17) Fill power steering reservoir to correct fluid level.

(18) Connect negative cable back on negative post of battery.

(19) Start the engine and let run for a few seconds. Then turn the engine off.

(20) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(21) Raise front wheels of vehicle off the ground.

(22) Start engine, then slowly turn steering wheel right and left several times until lightly contacting the wheel stops. Then turn the engine off.

(23) Add power steering fluid if necessary.

(24) Lower the vehicle. Start engine again and turn the steering wheel slowly from lock to lock.

(25) Stop the engine. Check the fluid level and refill as required.

(26) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(27) After power steering pump is installed, check for leaks at all hose connections and power steering pump fittings.

## POWER STEERING PUMP (2.5L ENGINE - LATER PRODUCTION)

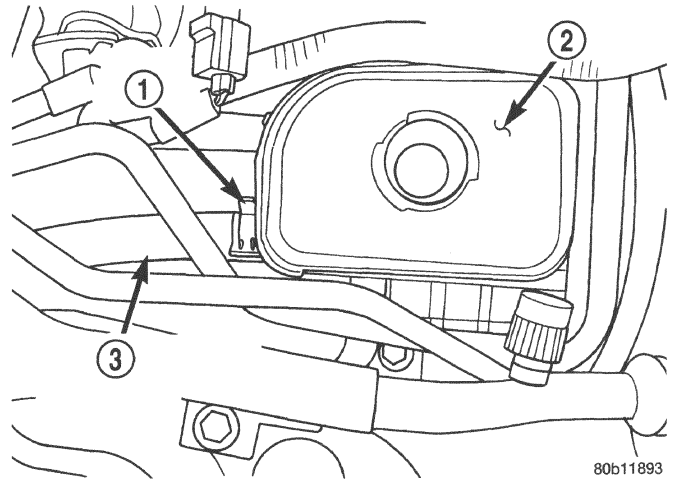
**WARNING: POWER STEERING FLUID, ENGINE COMPONENTS AND EXHAUST SYSTEM MAY BE EXTREMELY HOT IF ENGINE HAS BEEN RUNNING. DO NOT START ENGINE WITH ANY LOOSE OR DISCONNECTED HOSES, OR ALLOW HOSES TO TOUCH HOT EXHAUST MANIFOLD OR CATALYST.**

## REMOVAL

(1) Remove battery cable from (-) negative post on battery and isolate cable.

(2) Siphon as much power steering fluid as possible out of the remote power steering fluid reservoir.

(3) Remove the power steering fluid supply hose from the power steering fluid reservoir (Fig. 12). Fluid supply hose will be removed with the power steering pump.



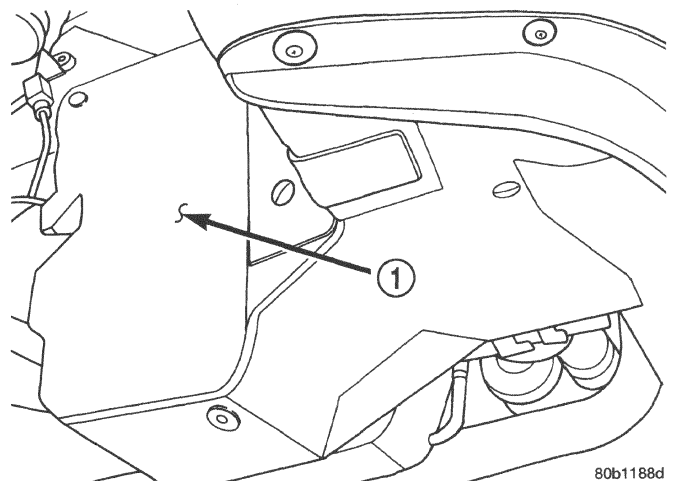
**Fig. 12 Supply Hose At Power Steering Fluid Reservoir**

- 1 - HOSE CLAMP
- 2 - POWER STEERING FLUID RESERVOIR
- 3 - POWER STEERING FLUID SUPPLY HOSE

(4) Raise vehicle.

(5) Remove right front tire from vehicle.

(6) Remove accessory drive splash shield (Fig. 13).

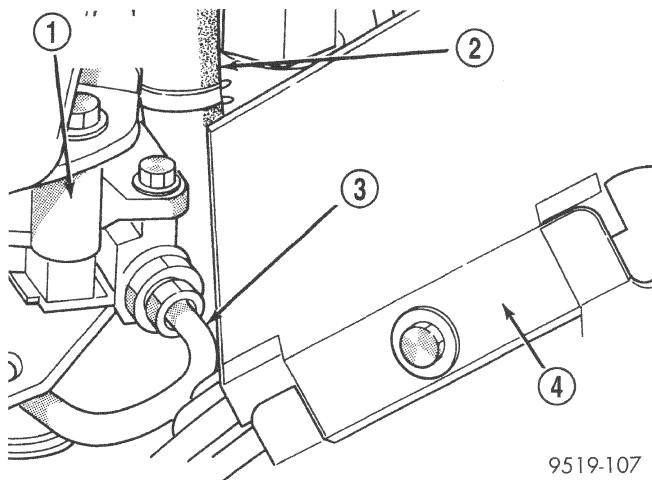


**Fig. 13 Accessory Drive Splash Shield**

- 1 - SPLASH SHIELD

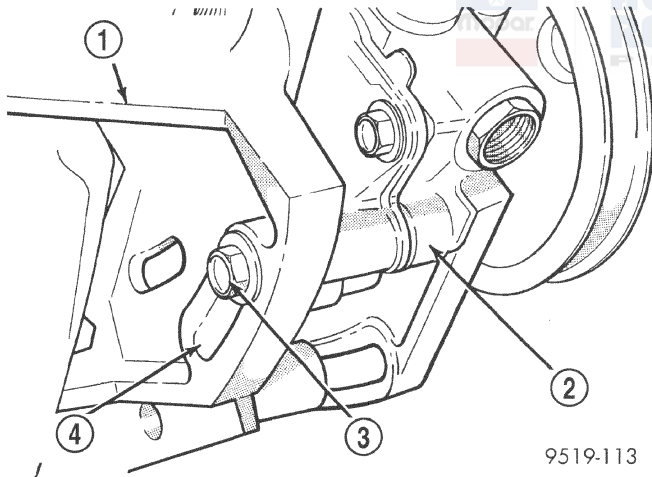
(7) Remove the heat shield for the antilock brakes hydraulic control unit (Fig. 14).



**REMOVAL AND INSTALLATION (Continued)****Fig. 14 Hydraulic Control Unit Heat Shield**

- 1 - POWER STEERING PUMP
- 2 - POWER STEERING FLUID SUPPLY HOSE
- 3 - POWER STEERING FLUID PRESSURE HOSE
- 4 - ABS HYDRAULIC CONTROL UNIT HEAT SHIELD

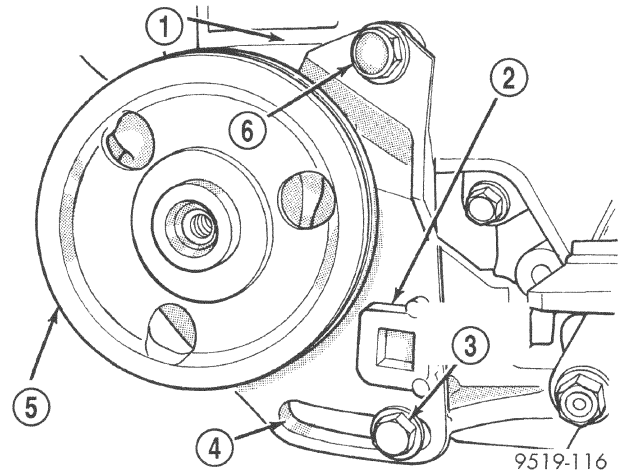
(8) Loosen bolt at adjusting slot in accessory drive mounting bracket (Fig. 15) attaching back of power steering pump to the bracket.

**Fig. 15 Power Steering Pump Rear Mounting Bolt**

- 1 - ACCESSORY DRIVE MOUNTING BRACKET
- 2 - POWER STEERING PUMP
- 3 - BOLT
- 4 - ADJUSTING SLOT

(9) Loosen bolt (Fig. 16) at top of power steering pump front mounting bracket, attaching it to the accessory drive bracket.

(10) Loosen bolt at adjustment slot, (Fig. 16) attaching the power steering pump front mounting bracket to cast aluminum accessory drive bracket on engine.

**Fig. 16 Power Steering Pump Front Bracket Attachment**

- 1 - ENGINE ACCESSORY DRIVE BRACKET
- 2 - POWER STEERING PUMP FRONT MOUNTING BRACKET
- 3 - BOLT
- 4 - ADJUSTING SLOT
- 5 - POWER STEERING PUMP
- 6 - BOLT

(11) Move the power steering pump toward the engine as far as possible.

(12) Remove the power steering fluid pressure hose from pressure fitting on power steering pump (Fig. 17). Be careful not to loose the copper sealing washers on both sides of the hose banjo fitting once the flow bolt is removed. Let the remaining power steering fluid drain out of the power steering fluid supply hose, power steering pump and power steering fluid pressure hose. **After power steering fluid has drained out of pump and hose, install a cap on the power steering pressure hose and a plug in the power steering pump pressure fitting.**

(13) Remove the power steering pump drive belt from power steering pump pulley.

(14) Remove bolt at adjusting slot in accessory drive mounting bracket, (Fig. 15) attaching back of power steering pump to the bracket.

(15) Remove bolt at adjustment slot, (Fig. 16) attaching the power steering pump front mounting bracket to cast aluminum accessory drive bracket on engine. Then remove bolt (Fig. 16) at top of power steering front mounting bracket, attaching it to the accessory drive bracket.

(16) Remove power steering pump, supply hose and its front mounting bracket as an assembly from the engine mounted power steering pump mounting bracket. Place the power steering pump on top of the antilock brakes hydraulic control unit.

## REMOVAL AND INSTALLATION (Continued)

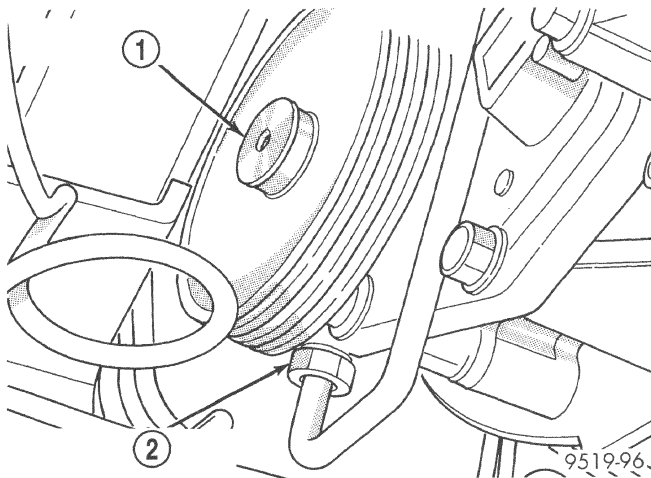


Fig. 17 Pump Pressure Hose At Fitting

- 1 - POWER STEERING PUMP
- 2 - POWER STEERING PUMP PRESSURE HOSE

**NOTE:** The power steering pump can not be removed from the vehicle without first removing the power steering pump mounting bracket from the engine.

(17) Remove the 4 bolts mounting the power steering pump mounting bracket to the engine.

(18) Remove the power steering pump mounting bracket from the engine. Position the power steering pump mounting bracket where it will not be in the way when removing power steering pump from the vehicle.

(19) Remove power steering pump, fluid supply hose and front mounting bracket as an assembly from the engine and vehicle. Pump, fluid supply hose and mounting bracket is removable by bringing it out through area between rear of engine, frame driveshaft and front suspension crossmember (Fig. 18).

(20) Transfer required parts from removed power steering pump to replacement power steering pump.

## INSTALLATION

(1) Install power steering pump, mounting bracket and fluid supply hose as an assembly back in vehicle, using the reverse of the removal procedure. **Be sure power steering fluid supply hose is correctly routed up to the power steering fluid reservoir when installing power steering pump.**

(2) Place the power steering pump on top of the antilock brakes hydraulic control unit.

(3) Install the power steering pump mounting bracket on the rear of the engine. Tighten the mounting bracket attaching bolts to a torque of 54 N·m (40 ft. lbs.).

(4) Install power steering pump and front bracket on engine mounted power steering pump mounting

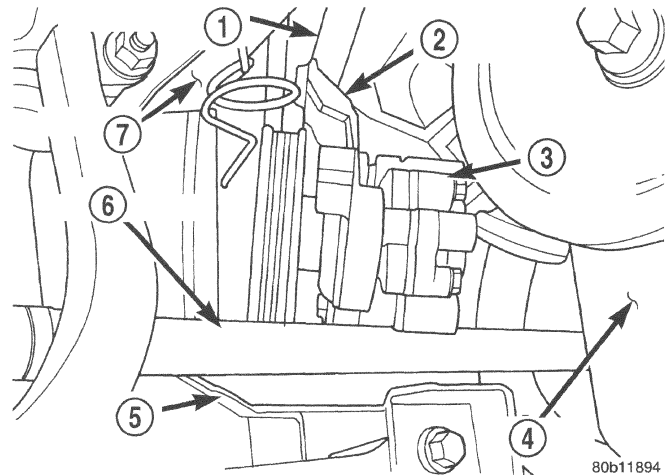


Fig. 18 Power Steering Pump Removal/Installation

- 1 - SUPPLY HOSE
- 2 - MOUNTING BRACKET
- 3 - POWER STEERING PUMP
- 4 - ENGINE
- 5 - FRONT SUSPENSION CROSSMEMBER
- 6 - DRIVESHAFT
- 7 - FRAME

bracket. Loosely install bolt at adjusting slot and top of power steering pump front bracket (Fig. 16) mounting pump bracket to accessory drive bracket.

(5) Loosely install the bolt mounting power steering pump to its rear mounting bracket (Fig. 15).

(6) Using a lint free towel, wipe clean all open power steering hose ends, and power steering pump fittings.

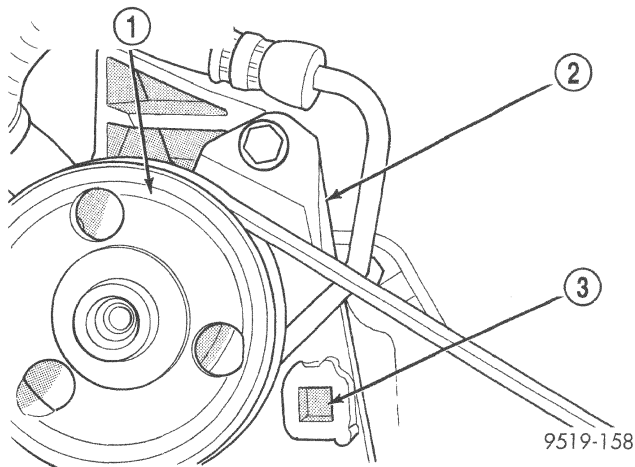
(7) Install a new O-ring on end of power steering pressure hose fitting. Lubricate all O-rings using fresh clean power steering fluid.

(8) Install the power steering pressure hose on the power steering pump pressure fitting. Loosely install tube nut into pressure fitting on power steering pump (Fig. 17). **Pressure hose must be installed between the front bracket of the power steering pump and power steering pump pulley.**

(9) Install power steering pump drive belt on power steering pump pulley.

(10) Install a 1/2 inch breaker bar in the square adjusting hole in the front power steering pump mounting bracket (Fig. 19), then rotate pump to obtain the correct drive belt tension. Refer to COOLING SYSTEM (Group 7) of this service manual for the correct drive belt tension specification. When correct drive belt tension is obtained, first tighten the bottom 2 adjusting slot bolts at the power steering pump cast mounting bracket to a torque of 54 N·m (40 ft. lbs.), then tighten the power steering pump mounting bracket top pivot bolt to a torque of 54 N·m (40 ft. lbs.).



**REMOVAL AND INSTALLATION (Continued)**

**Fig. 19 Power Steering Pump Front Mounting Bracket Adjusting Hole**

- 1 - POWER STEERING PUMP  
2 - POWER STEERING PUMP MOUNTING BRACKET  
3 - ADJUSTING HOLE

(11) Position power steering pressure hose, so hose is not contacting the power steering pump pulley or the drive belt. Tighten the tube nut to a torque of 31 N·m (275 in. lbs.).

(12) Install heat shield on hydraulic control unit (Fig. 14).

(13) Install accessory drive splash shield (Fig. 13).

(14) Install wheel and tire. Tighten the wheel lug nuts in proper sequence until all lug nuts are torqued to half specification. Then repeat tightening sequence to full specified torque of 129 N·m (95 ft. lbs.).

(15) Lower vehicle.

(16) Install power steering fluid supply hose (Fig. 12) on power steering fluid reservoir fitting. Install hose clamp on hose. Be sure hose clamp is installed on hose past upset bead on power steering fluid reservoir.

**CAUTION: Do not use automatic transmission fluid in power steering system. Only use Mopar®, Power Steering Fluid, or equivalent.**

(17) Fill power steering reservoir to correct fluid level.

(18) Connect negative cable back on negative post of battery.

(19) Start the engine and let run for a few seconds. Then turn the engine off.

(20) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(21) Raise front wheels of vehicle off the ground.

(22) Start engine, then slowly turn steering wheel right and left several times until lightly contacting the wheel stops. Then turn the engine off.

(23) Add power steering fluid if necessary.

(24) Lower the vehicle. Start engine again and turn the steering wheel slowly from lock to lock.

(25) Stop the engine. Check the fluid level and refill as required.

(26) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

(27) After power steering pump is installed, check for leaks at all hose connections and power steering pump fittings.

**POWER STEERING FLUID RESERVOIR****REMOVAL**

(1) Using a siphon pump, remove as much power steering fluid as possible from the power steering fluid reservoir.

(2) Raise vehicle.

(3) Remove hose clamp attaching power steering fluid supply hose to fitting on power steering pump. Let power steering fluid drain from supply hose and power steering fluid reservoir, until reservoir is empty.

(4) Lower vehicle.

**CAUTION: Care must be used when removing and installing power steering fluid hoses on the power steering fluid reservoir. If excessive force is used when trying to remove or install hoses on nipples of power steering fluid reservoir, nipples can be broken off the reservoir.**

(5) Remove power steering fluid return and supply hose, from power steering fluid reservoir.

(6) Remove bolts attaching power steering fluid reservoir to engine.

(7) Remove power steering fluid reservoir from vehicle.

**INSTALLATION**

(1) Install power steering fluid reservoir on cylinder head. Install and securely tighten the power steering fluid reservoir attaching bolts.

(2) Install power steering fluid return and supply hose, on power steering fluid reservoir fittings. **Be sure both hose clamps are installed on hose past upset bead on power steering reservoir fittings.**

(3) Raise vehicle.

(4) Install power steering supply hose, on suction fitting of the power steering pump. **Be sure hose clamp is installed on hose past upset bead on power steering gear steel tube.**

## REMOVAL AND INSTALLATION (Continued)

(5) Fill power steering pump fluid reservoir to the proper level.

(6) Start the engine and let run for a few seconds. Then turn the engine off.

(7) Add fluid if necessary. Repeat the above procedure until the fluid level remains constant after running the engine.

(8) Raise front wheels of vehicle off the ground.

(9) Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops. Then turn the engine off.

(10) Add power steering fluid if necessary.

(11) Lower the vehicle and turn the steering wheel slowly from lock to lock.

(12) Stop the engine. Check the fluid level and refill as required.

(13) If the fluid is extremely foamy, allow the vehicle to stand a few minutes and repeat the above procedure.

## DISASSEMBLY AND ASSEMBLY

### POWER STEERING PUMP DRIVE PULLEY

The power steering pump must be removed from the vehicle for removal of the power steering pump pulley. Refer to Power Steering Pump Removal in the Power Steering Pump Service Procedures section in this group of the service manual.

### DISASSEMBLE

(1) Remove power steering pump from engine. Refer to Power Steering Pump Removal in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

**CAUTION:** Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

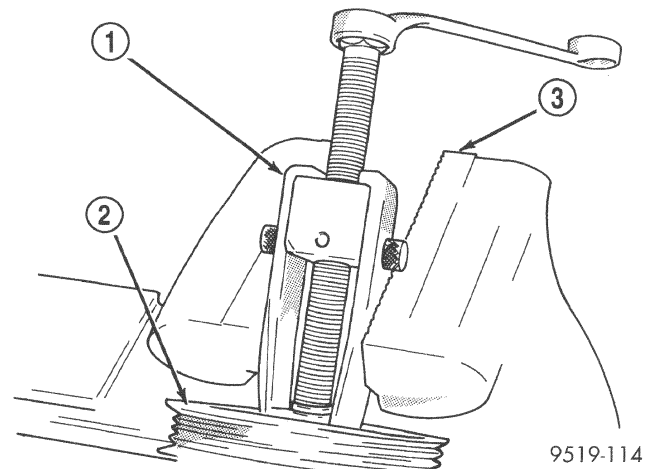
(2) Mount Puller, Special Tool C-4333 or C-4068 on power steering pump pulley. Mount power steering pump and puller in a vise (Fig. 20) to keep shaft of power steering pump from turning when removing pulley.

(3) Remove the drive pulley from the shaft of the power steering pump.

(4) Replace power steering pump pulley if bent, cracked, or loose.

### ASSEMBLE

**CAUTION:** Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

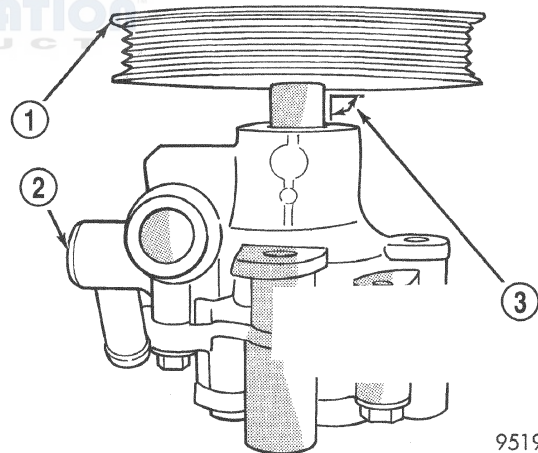


**Fig. 20 Removing Pulley From Power Steering Pump Shaft**

- 1 - SPECIAL TOOL C-4333 OR C-4068
- 2 - POWER STEERING PUMP PULLEY
- 3 - VISE

(1) Mount power steering pump in a vise using the power steering pump mounting bracket.

(2) Place power steering pump pulley squarely on end of power steering pump shaft (Fig. 21).



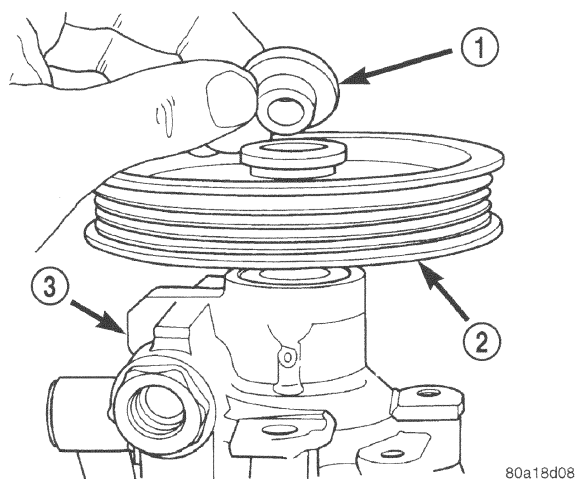
**Fig. 21 Pulley Positioned On Shaft Of Power Steering Pump**

- 1 - POWER STEERING PUMP PULLEY
- 2 - POWER STEERING PUMP
- 3 - POWER STEERING PUMP PULLEY MUST BE STARTED SQUARELY ON SHAFT OF POWER STEERING PUMP AS SHOWN

(3) Place Installation Spacer, Special Tool 6936, (Fig. 22) on top of the power steering pump pulley.

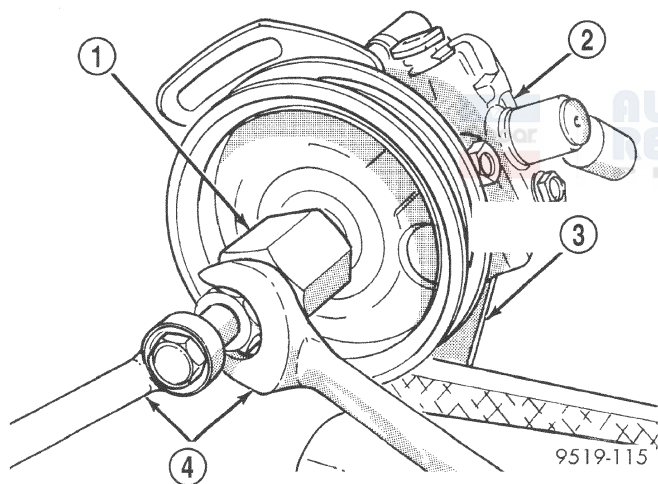
(4) Mount Installer, Special Tool C-4063 in internal threads of the power steering pump shaft and against Special Tool 6936 on power steering pump pulley (Fig. 23).



**DISASSEMBLY AND ASSEMBLY (Continued)**

**Fig. 22 Special Tool 6936 Correctly Installed On Power Steering Pump Pulley**

- 1 - SPECIAL TOOL 6936
- 2 - POWER STEERING PUMP PULLEY
- 3 - POWER STEERING PUMP



**Fig. 23 Installing Pulley On Shaft Of Power Steering Pump**

- 1 - SPECIAL TOOL C-4063
- 2 - POWER STEERING PUMP
- 3 - POWER STEERING PUMP BRACKET
- 4 - WRENCHES

(5) Ensuring that special tool and pulley remain aligned with pump shaft, force pulley onto power steering pump shaft until Special Tool 6936 is against the end of the power steering pump shaft. **When Special Tool 6936 is against the shaft of the power steering pump Special Tool C-4063 will no longer be able to be turned.**

(6) Remove Installer, Special Tool C-4063 from power steering pump.

(7) Install power steering pump and mounting bracket back on engine. Refer to Power Steering Pump Installation in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

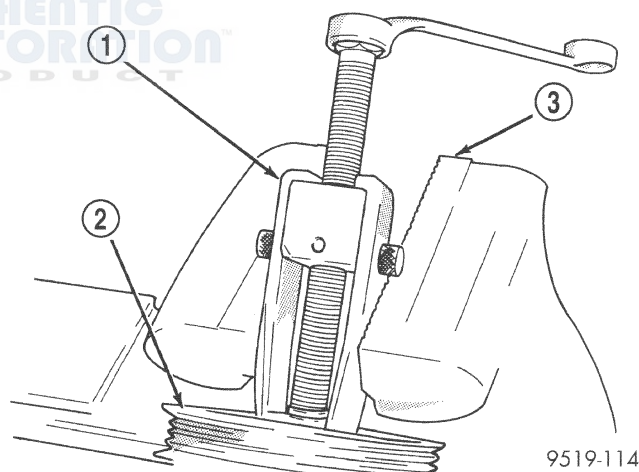
## **POWER STEERING PUMP MOUNTING BRACKET**

### **DISASSEMBLE**

(1) Remove power steering pump from engine. Refer to Power Steering Pump Removal in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

**CAUTION: Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.**

(2) Mount Puller, Special Tool C-4333 or C-4068 on power steering pump pulley. Mount power steering pump and puller in a vise (Fig. 24) to keep shaft of power steering pump from turning when removing pulley.



**Fig. 24 Removing Pulley From Power Steering Pump Shaft**

- 1 - SPECIAL TOOL C-4333 OR C-4068
- 2 - POWER STEERING PUMP PULLEY
- 3 - VISE

(3) Remove the drive pulley from the shaft of the power steering pump.

(4) Remove bolts attaching power steering pump to mounting bracket.

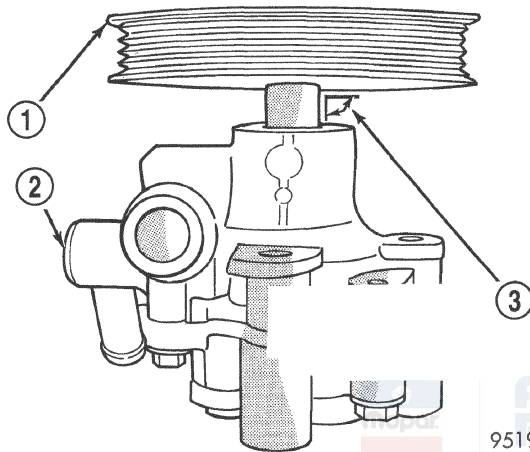
(5) Remove power steering pump from mounting bracket.

**DISASSEMBLY AND ASSEMBLY (Continued)****ASSEMBLE**

(1) Install power steering pump on mounting bracket. Install the power steering pump to mounting bracket attaching bolts. Torque the mounting bolts to 54 N·m (40 ft. lbs).

**CAUTION:** Do not hammer on power steering pump pulley or shaft to remove power steering pump pulley. This will damage the pulley and the power steering pump.

(2) Place power steering pump pulley squarely on end of power steering pump shaft (Fig. 25).



**Fig. 25 Pulley Positioned On Shaft Of Power Steering Pump**

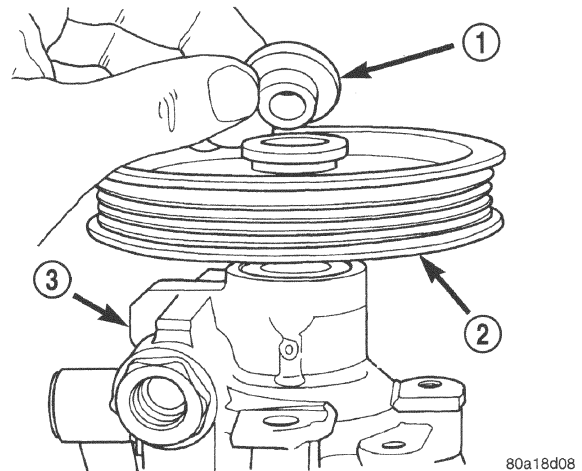
- 1 - POWER STEERING PUMP PULLEY
- 2 - POWER STEERING PUMP
- 3 - POWER STEERING PUMP PULLEY MUST BE STARTED SQUARELY ON SHAFT OF POWER STEERING PUMP AS SHOWN

(3) Place Installation Spacer, Special Tool 6936 on top of the power steering pump pulley (Fig. 26).

(4) Mount Installer, Special Tool C-4063 in internal threads of the power steering pump shaft and against Special Tool 6936 on power steering pump pulley (Fig. 27).

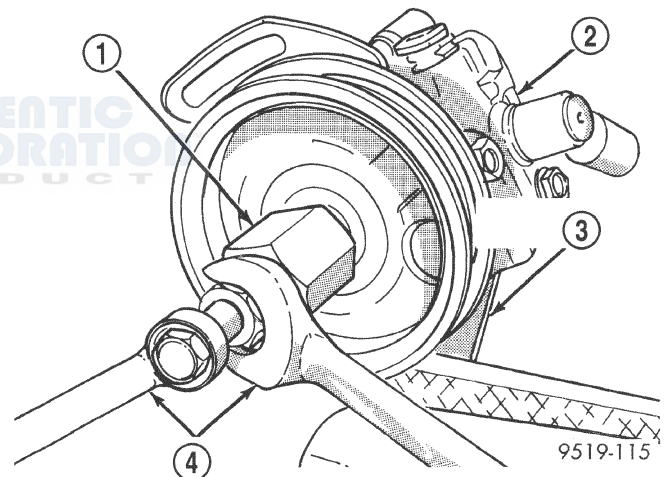
(5) Ensuring that special tool and pulley remain aligned with pump shaft, force pulley onto power steering pump shaft until Special Tool 6936 is against the end of the shaft. **When Special Tool 6936 is against the shaft of the power steering pump, Special Tool C-4063 will no longer be able to be turned.**

(6) Remove Installer, Special Tool C-4063 from power steering pump.



**Fig. 26 Spacer Correctly Installed On Power Steering Pump Pulley**

- 1 - SPECIAL TOOL 6936
- 2 - POWER STEERING PUMP PULLEY
- 3 - POWER STEERING PUMP



**Fig. 27 Installing Pulley On Shaft Of Power Steering Pump**

- 1 - SPECIAL TOOL C-4063
- 2 - POWER STEERING PUMP
- 3 - POWER STEERING PUMP BRACKET
- 4 - WRENCHES

(7) Install power steering pump and bracket assembly back on engine. Refer to Power Steering Pump Installation in the Power Steering Pump Service Procedures section in this group of the service manual for required procedure.

SPECIFICATIONS

POWER STEERING PUMP FLOW SPECIFICATIONS

Flow At 1500 RPM And Minimum  
Pressure . . . . . 4.9 to 5.3 Liters/Min  
(1.3 to 1.4 GPM)  
Control Valve Pressure Relief . . . 8240 to 8920 kPa  
(1195 to 1293 psi)

POWER STEERING PUMP FASTENER TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
<b>POWER STEERING PUMP:</b>	
Discharge Fitting . . . . .	75 N·m (55 ft. lbs.)
Rear Bracket Mounting Bolts . . . . .	54 N·m (40 ft. lbs.)
Front Bracket Mounting Bolts . . . . .	54 N·m (40 ft. lbs.)
Bracket To Engine Mounting Bolts . . . . .	54 N·m (40 ft. lbs.)

POWER STEERING FLUID HOSES:

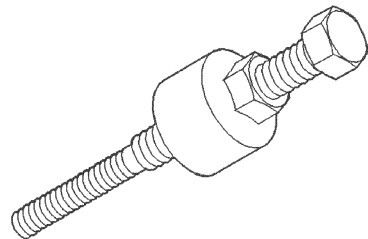
Hose Tube Nuts . . . . .	31 N·m (275 in. lbs.)
Pressure Hose To Cylinder Head 2.5L . . .	54 N·m (40 ft. lbs.)
Return Hose To Pressure Hose Bracket 2.5L . . . . .	9 N·m (75 in. lbs.)

POWER STEERING FLUID RESERVOIR:

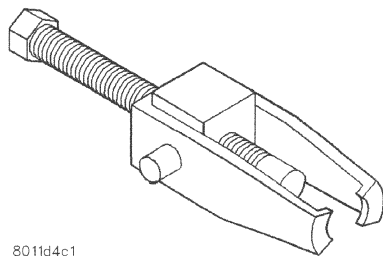
Reservoir To Mounting Bracket Or Engine . . . . .	28 N·m (21 ft. lbs.)
Reservoir Bracket To Engine . . . . .	28 N·m (21 ft. lbs.)

SPECIAL TOOLS

POWER STEERING PUMP



Installer C-4063B



8011d4c1

Puller C-4333

## POWER STEERING GEAR

### TABLE OF CONTENTS

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### DESCRIPTION AND OPERATION

#### POWER STEERING GEAR

##### DESCRIPTION

The steering gear on this vehicle is a rack and pinion unit with power assist (Fig. 1). It is mounted on the front suspension crossmember. The steering column connects to the steering gear shaft on top of the gear. The outer tie rod ends of the gear connect to each suspension steering knuckle to steer the vehicle.

Depending on the vehicle production date, the vehicle could use one of two power steering gears. There is an early production steering gear and a later production gear. Externally, the power steering gears appear the same. Without a parts book, the easiest way to identify whether your car is equipped with an early or later production steering gear is to identify what type of steering column intermediate shaft the vehicle has. Early models use a intermediate shaft with a slap coupler connection at the steering gear pinion shaft (Fig. 2). Later models use a slider-stage style intermediate shaft (Fig. 3).

An easy way to identify an isolated steering gear is to look at the very end of the pinion shaft. Early

models have 2 parallel flats on the end where the steering column intermediate shaft would bolt up (Fig. 4). Later models have 2 flats that are at 60 degree angles to one another where the steering column intermediate shaft would bolt up (Fig. 4).

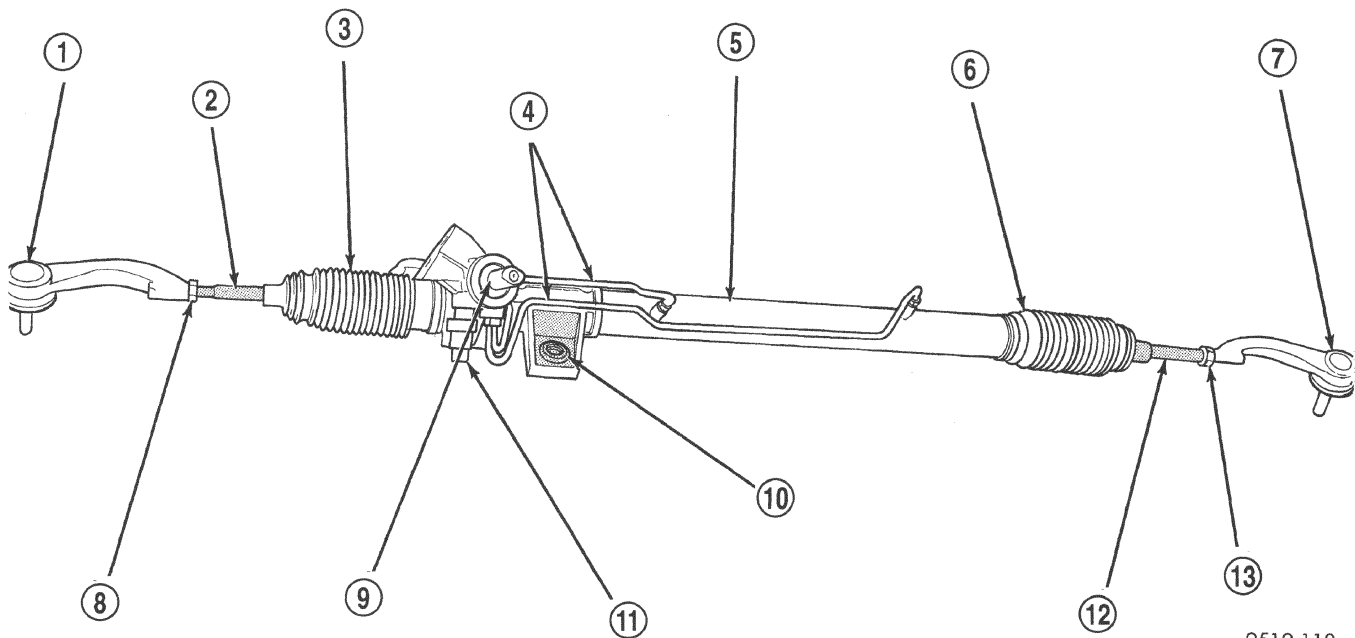
##### OPERATION

Turning of the steering wheel is converted into linear travel through the meshing of the helical pinion teeth with the rack teeth. Power assist steering is provided by an open center, rotary type control valve which directs fluid from the pump to either side of the integral rack piston.

Road feel is controlled by the diameter of a torsion bar which initially steers the vehicle. This movement directs fluid behind the integral rack piston, which, in turn, builds up hydraulic pressure and assists in the turning effort.

The drive tangs on the gear pinion mate loosely with a stub shaft. This is to permit manual steering control to be maintained if the drive belt on the power steering pump should break. However, under these conditions, steering effort will be increased.

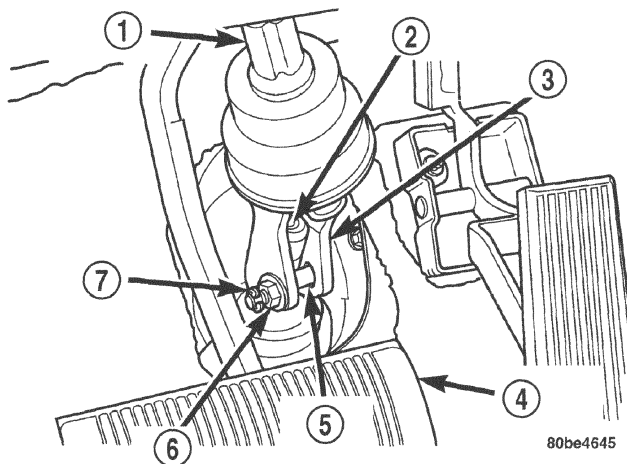


**DESCRIPTION AND OPERATION (Continued)**

9519-118

**Fig. 1 Power Steering Gear**

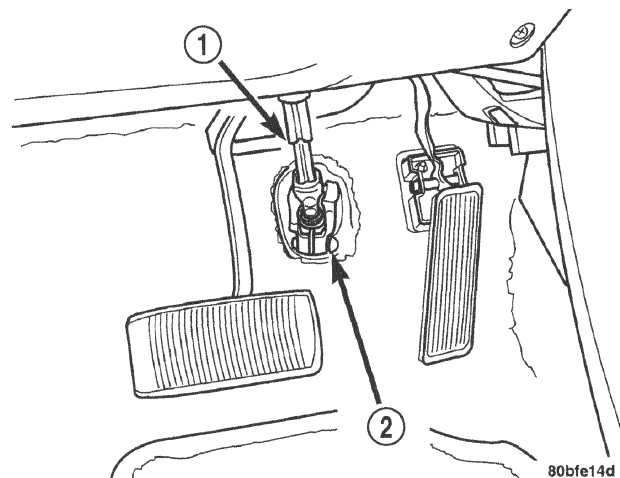
- |                                 |                                     |
|---------------------------------|-------------------------------------|
| 1 - TIE ROD END                 | 8 - JAM NUT                         |
| 2 - INNER TIE ROD               | 9 - STEERING GEAR SHAFT             |
| 3 - STEERING GEAR BOOT          | 10 - MOUNTING BUSHING               |
| 4 - STEERING GEAR FLUID LINES   | 11 - POWER STEERING PRESSURE SWITCH |
| 5 - POWER STEERING GEAR HOUSING | 12 - INNER TIE ROD                  |
| 6 - STEERING GEAR BOOT          | 13 - JAM NUT                        |
| 7 - TIE ROD END                 |                                     |



80be4645

**Fig. 2 Slap Coupler Intermediate Shaft**

- |                         |
|-------------------------|
| 1 - INTERMEDIATE SHAFT  |
| 2 - STEERING GEAR SHAFT |
| 3 - COUPLER             |
| 4 - BRAKE PEDAL         |
| 5 - PINCH BOLT          |
| 6 - NUT                 |
| 7 - "E" CLIP            |

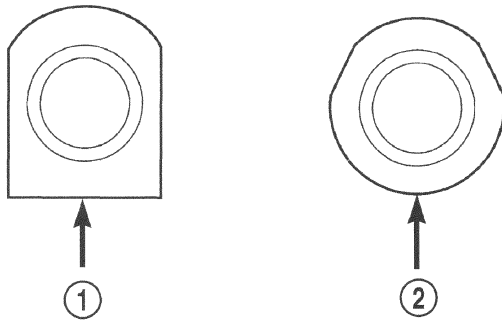


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**Fig. 3 Slider-Stage Intermediate Shaft**

- |                        |
|------------------------|
| 1 - INTERMEDIATE SHAFT |
| 2 - PINCH BOLT         |

## DESCRIPTION AND OPERATION (Continued)



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**Fig. 4 Pinion Shaft Identification**

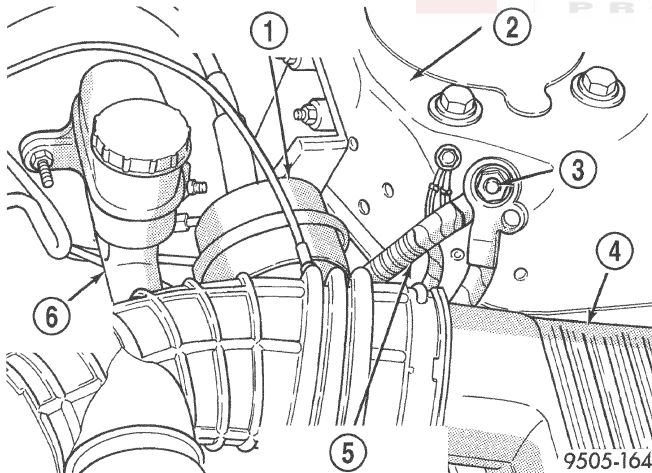
- 1 - EARLY PRODUCTION
- 2 - LATER PRODUCTION

## REMOVAL AND INSTALLATION

## POWER STEERING GEAR

## REMOVAL

(1) Remove remote ground cable (Fig. 5) from ground stud on shock tower. Then correctly isolate ground cable from vehicle by installing isolator on stud (Fig. 6).



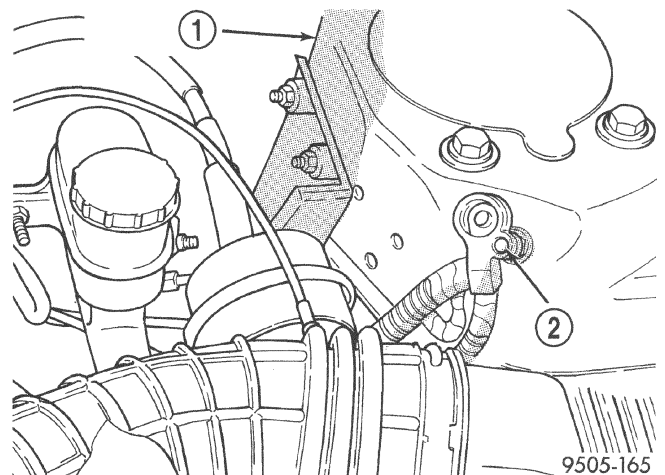
9505-164

**Fig. 5 Remote Ground Cable At Shock Tower**

- 1 - SPEED CONTROL SERVO
- 2 - LEFT STRUT TOWER
- 3 - GROUND STUD
- 4 - AIR CLEANER
- 5 - REMOTE GROUND CABLE
- 6 - MASTER CYLINDER

(2) Siphon as much power steering fluid as possible from the remote power steering fluid reservoir.

(3) Place the steering wheel and front wheels in the STRAIGHT-AHEAD position. Lock the steering wheel in this position using a steering wheel holder.



9505-165

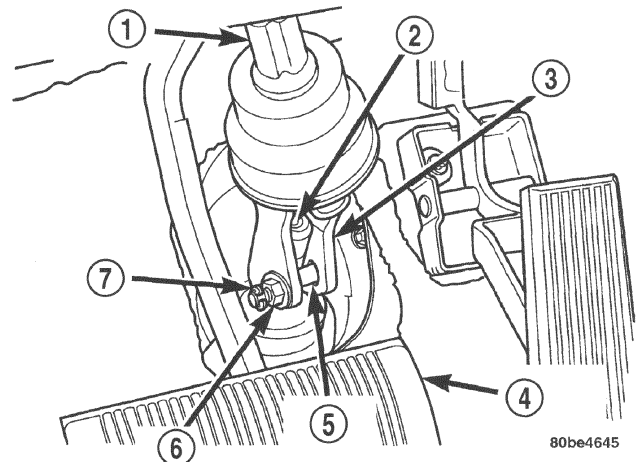
**Fig. 6 Correctly Isolated Remote Ground Cable**

- 1 - LEFT STRUT TOWER
- 2 - GROUND STUD

(4) Under the instrument panel, disconnect the intermediate shaft from the steering gear shaft. To do so, perform one of the following that applies:

(a) On early production vehicles, remove the "E" clip from the steering column intermediate shaft coupler pinch bolt. Next, remove the pinch bolt from the intermediate shaft coupler by backing off the nut, then separate the intermediate shaft from steering gear shaft.

(b) On later production vehicles, remove the pinch bolt from the intermediate shaft coupler (Fig. 8), then slide the intermediate shaft up and off the steering gear shaft.

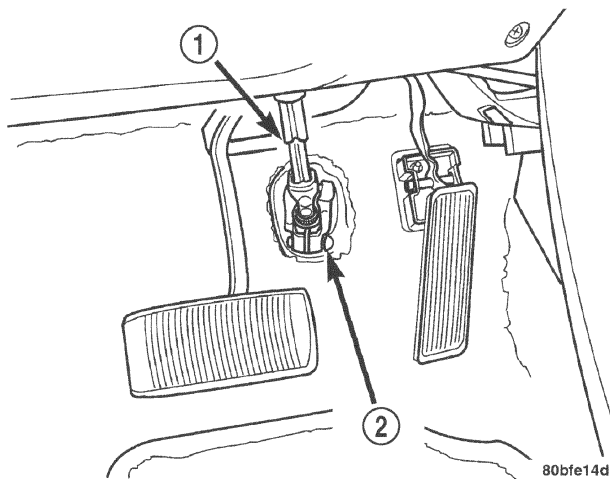


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**Fig. 7 Early Intermediate Shaft Attachment**

- 1 - INTERMEDIATE SHAFT
- 2 - STEERING GEAR SHAFT
- 3 - COUPLER
- 4 - BRAKE PEDAL
- 5 - PINCH BOLT
- 6 - NUT
- 7 - "E" CLIP

## REMOVAL AND INSTALLATION (Continued)

**Fig. 8 Later Intermediate Shaft Attachment**

- 1 - INTERMEDIATE SHAFT
- 2 - PINCH BOLT

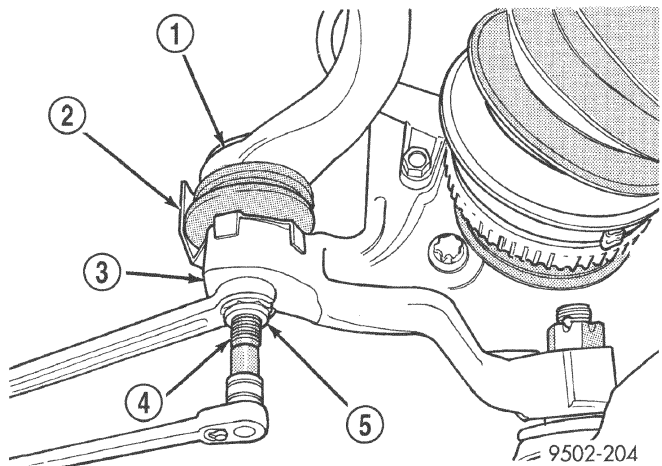
(5) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(6) Remove both front wheel and tire assemblies from the vehicle.

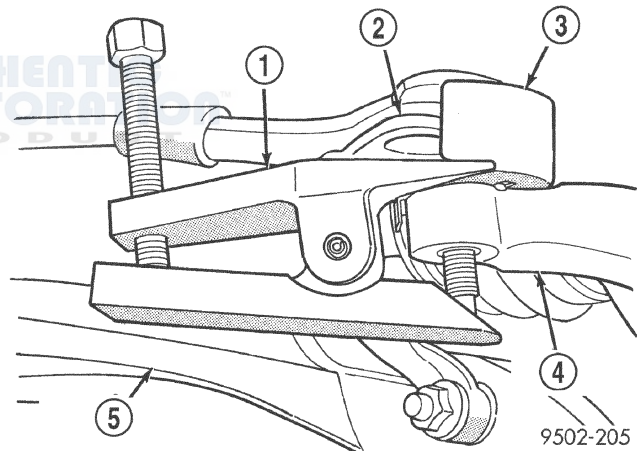
(7) Remove nuts attaching both outer tie rod ends to the steering knuckles (Fig. 9). **Nuts are to be removed from tie rod ends using the following procedure, hold tie rod end stud with an 11/32 socket, while loosening and removing nut with wrench (Fig. 9).**

(8) Remove both tie rod end studs, from the steering knuckles, using Remover, Special Tool MB-991113 (Fig. 10).

**CAUTION:** This vehicles is designed and assembled using NET BUILD front suspension alignment settings. This means that front suspension alignment settings are determined as the vehicle is designed by the location of front suspension components in relation to the vehicle body. This process is carried out when building the vehicle, by accurately locating the front suspension crossmember to master gage holes located in the underbody of the vehicle. With this method of designing and building a vehicle, it is no longer necessary or possible to adjust a vehicles front suspension alignment settings. Consequently, whenever the front suspension crossmember is removed from a vehicle, it **MUST** be replaced in the same location on the body of the vehicle it was removed from. Front suspension Toe settings though are still adjustable by the outer tie rod ends.

**Fig. 9 Removing Tie Rod End Nut**

- 1 - TIE ROD END
- 2 - HEAT SHIELD
- 3 - STEERING KNUCKLE
- 4 - TIE ROD END STUD
- 5 - NUT

**Fig. 10 Tie Rod End Removal From Steering Knuckle**

- 1 - SPECIAL TOOL MB-991113
- 2 - TIE ROD END
- 3 - HEAT SHIELD
- 4 - STEERING KNUCKLE
- 5 - LOWER CONTROL ARM

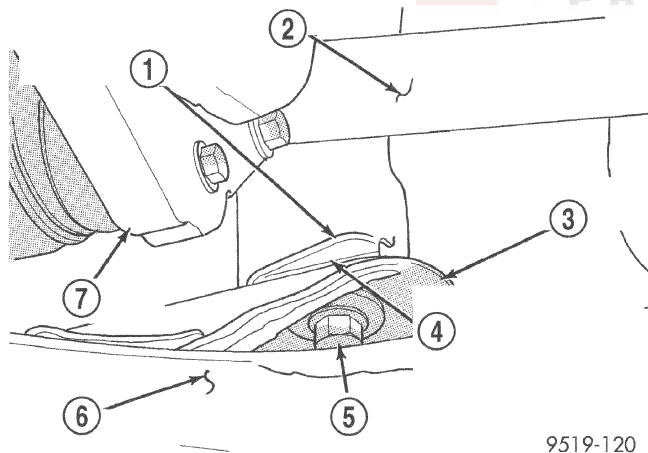


## REMOVAL AND INSTALLATION (Continued)

**CAUTION:** Before removing the front suspension crossmember from the vehicle, locating marks for the front suspension crossmember **MUST** be scribed on the front suspension crossmember and body of vehicle. This must be done so front suspension crossmember can be located against body of vehicle, in the same location when it is installed back in vehicle. If location of front suspension crossmember to body of vehicle is not maintained when vehicle is assembled, **NET BUILD** front suspension alignment settings will not be obtained. This may lead to handling and or tire wear problems.

**NOTE:** Use the following procedure to mark the side to side and front to back installed location of the front suspension crossmember to the body of the vehicle.

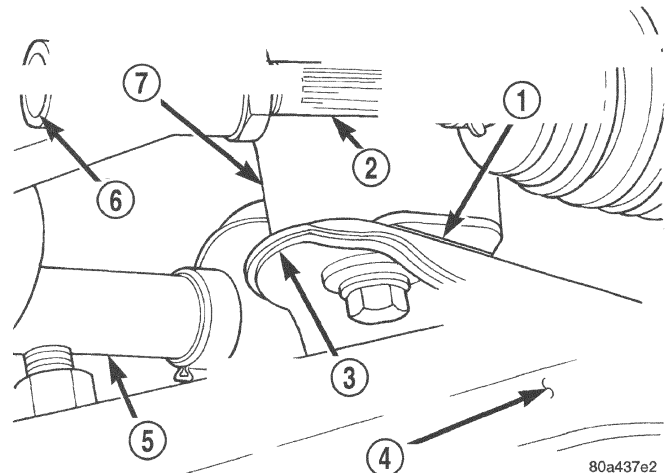
(9) Using an awl, scribe a line on the body (Fig. 11) and (Fig. 12) marking the front to back installed location where the front suspension crossmember is mounted against the body of the vehicle. The line should be scribed at both the front and back of where the crossmember is mounted to the vehicle and on each side of the vehicle. In (Fig. 11) and (Fig. 12) the left side of the vehicle is shown.



**Fig. 11 Front Suspension Crossmember Front To Back Locating Mark (Left Side Front)**

- 1 - FRAME RAIL TO CROSSMEMBER ATTACHING BRACKET
- 2 - DRIVESHAFT
- 3 - FRONT SUSPENSION CROSSMEMBER
- 4 - FRONT SUSPENSION CROSSMEMBER TO BODY FRONT TO BACK LOCATING MARK
- 5 - FRONT SUSPENSION CROSSMEMBER MOUNTING BOLT
- 6 - FRONT LOWER CONTROL ARM
- 7 - TRANSAXLE

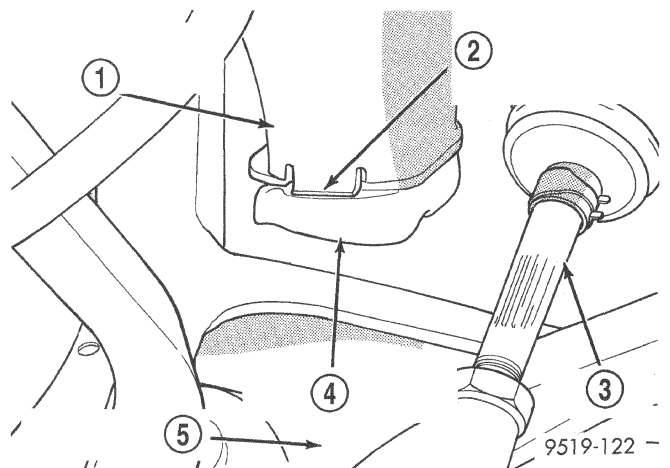
(10) Using an awl, scribe a line on the front suspension crossmember (Fig. 13) marking the side to side installed location where front suspension cross-



**Fig. 12 Front Suspension Crossmember Front To Back Locating Mark (Left Side Rear)**

- 1 - FRONT SUSPENSION CROSSMEMBER TO BODY, FRONT TO BACK LOCATING MARK
- 2 - INNER TIE ROD
- 3 - FRONT SUSPENSION CROSSMEMBER
- 4 - LOWER CONTROL ARM
- 5 - DRIVESHAFT
- 6 - OUTER TIE ROD
- 7 - FRAME RAIL TO CROSSMEMBER ATTACHING BRACKET

member is mounted against the body of the vehicle. The line should be scribed at the side of the frame rail bracket (Fig. 13) where the crossmember is mounted to the vehicle. The locating mark is to be marked the same on each side of the vehicle. In (Fig. 13) the left side of the vehicle is shown.



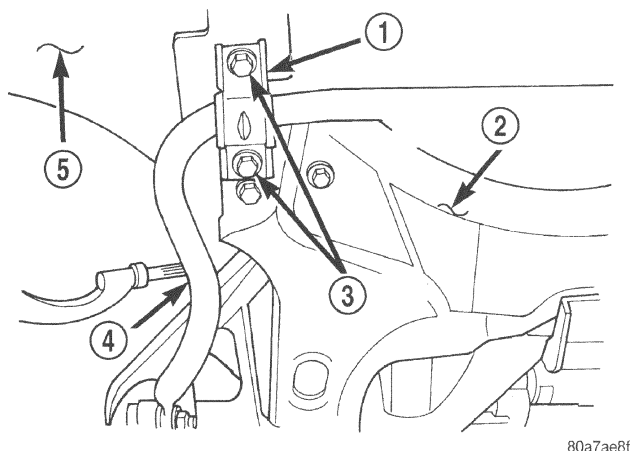
**Fig. 13 Front Suspension Crossmember Side To Side Locating Mark**

- 1 - FRAME RAIL TO CROSSMEMBER BRACKET
- 2 - FRONT SUSPENSION CROSSMEMBER TO BODY SIDE TO SIDE LOCATING MARK
- 3 - INNER TIE ROD
- 4 - FRONT SUSPENSION CROSSMEMBER
- 5 - LOWER CONTROL ARM



**REMOVAL AND INSTALLATION (Continued)**

(11) Remove the stabilizer bar bushing clamp to body attaching bolts only (Fig. 14). The sway bar bushing clamp to front suspension crossmember bolts (Fig. 14) do not need to be removed.



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**Fig. 14 Stabilizer Bar Bushing Clamp Attaching Bolts**

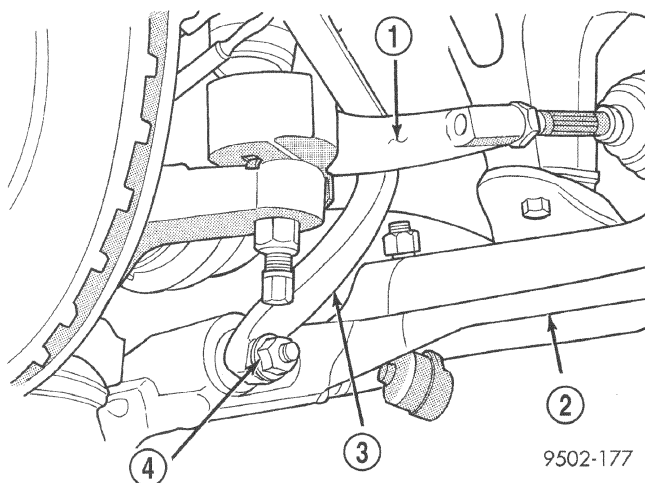
- 1 - STABILIZER BAR BUSHING CLAMP
- 2 - FRONT SUSPENSION CROSSMEMBER
- 3 - ATTACHING BOLTS
- 4 - STABILIZER BAR
- 5 - VEHICLE BODY

(12) If vehicle is equipped with antilock brakes, the hydraulic control unit can not hang from the brake tubes when lowering front suspension crossmember. Using wire, tie the antilock brakes hydraulic control unit to the body and engine so the wire will support it when the crossmember is lowered.

(13) If vehicle is equipped with antilock brakes, remove the 3 bolts attaching the antilock brakes hydraulic control unit to the front suspension crossmember.

(14) Remove the bolts attaching the shock absorber clevis to the left and right lower control arms (Fig. 15).

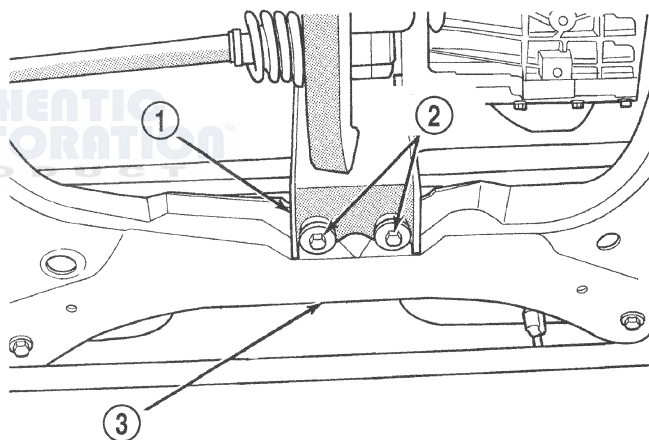
(15) Remove the 2 bolts attaching the under engine support bracket (Fig. 16) to the front edge of the front suspension crossmember.



9502-177

**Fig. 15 Shock Clevis To Lower Control Arm Bolts**

- 1 - TIE ROD END
- 2 - LOWER CONTROL ARM
- 3 - SHOCK ABSORBER CLEVIS
- 4 - THRU-BOLT



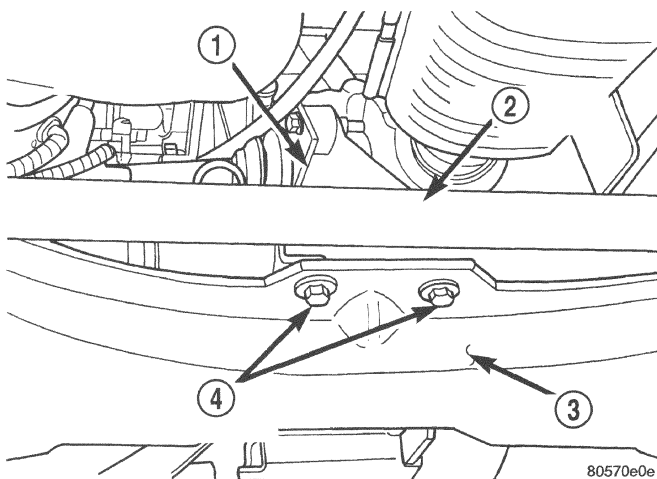
9519-123

**Fig. 16 Engine Support Bracket To Crossmember Attaching Bolts**

- 1 - ENGINE SUPPORT BRACKET
- 2 - ATTACHING BOLTS
- 3 - FRONT SUSPENSION CROSSMEMBER

## REMOVAL AND INSTALLATION (Continued)

(16) Remove the 2 attaching bolts from the rear support bracket (Fig. 17) at the rear of the front suspension crossmember.



**Fig. 17 Rear Support Bracket Attachment To Crossmember**

- 1 - REAR SUPPORT BRACKET
- 2 - STABILIZER BAR
- 3 - CROSSMEMBER
- 4 - ATTACHING BOLTS

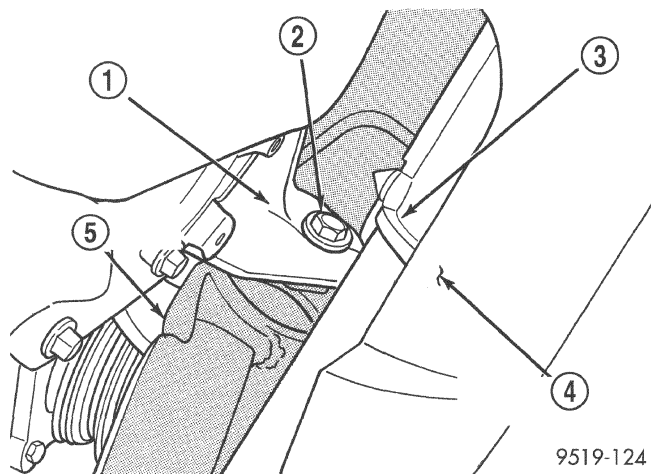
(17) Remove bolt (Fig. 18) attaching engine support bracket to the transaxle mounting bracket.

(18) Position a transmission jack under the center of the front suspension crossmember. Transmission jack is used to lower, support and raise front suspension crossmember when removing steering gear assembly.

(19) From each side of the vehicle, remove the 2 bolts attaching the front and rear of the front suspension crossmember to the frame rails of vehicle (Fig. 19).

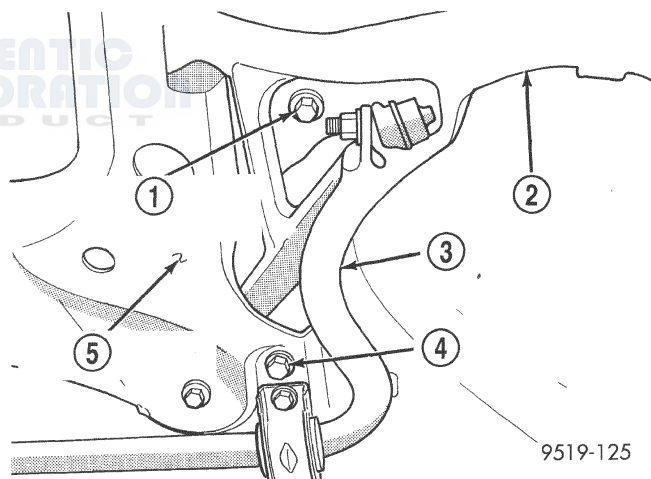
(20) Using transmission jack, lower front suspension crossmember enough to allow steering gear to be removed from crossmember. **When lowering front suspension crossmember, do not let crossmember hang from lower control arms, weight of crossmember must be supported by the transmission jack.**

(21) Remove power steering fluid, pressure and return hoses from the power steering gear assembly (Fig. 20).



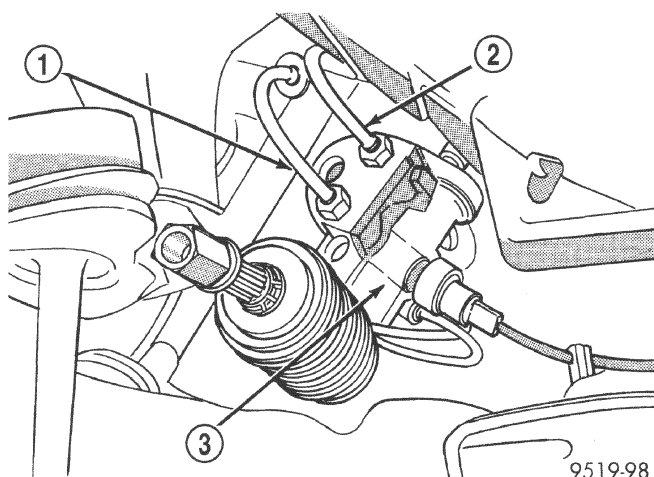
**Fig. 18 Engine Support Bracket To Transaxle Bracket Bolt**

- 1 - TRANSAXLE MOUNTING BRACKET
- 2 - BOLT
- 3 - STEERING GEAR
- 4 - FRONT SUSPENSION CROSSMEMBER
- 5 - ENGINE SUPPORT BRACKET



**Fig. 19 Crossmember To Body Attaching Bolts**

- 1 - CROSSMEMBER FRONT MOUNTING BOLT
- 2 - LOWER CONTROL ARM
- 3 - STABILIZER BAR
- 4 - CROSSMEMBER REAR MOUNTING BOLT
- 5 - FRONT SUSPENSION CROSSMEMBER

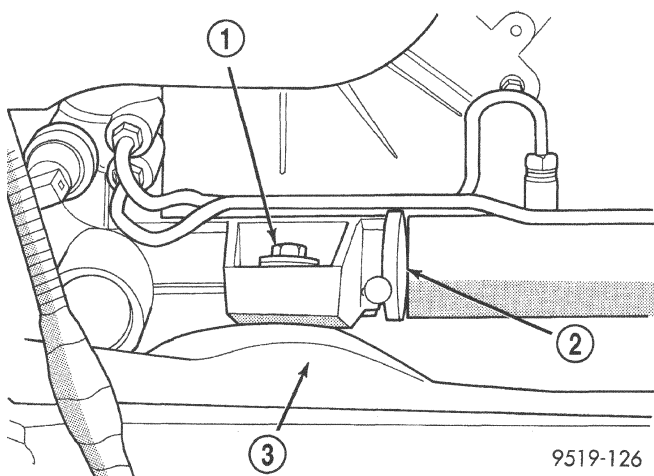
**REMOVAL AND INSTALLATION (Continued)**

**Fig. 20 Power Steering Pressure And Return Hose At Steering Gear**

- 1 - POWER STEERING PRESSURE HOSE
- 2 - POWER STEERING RETURN HOSE
- 3 - POWER STEERING GEAR

(22) Remove wiring harness connector, (Fig. 20) from the power steering fluid pressure switch.

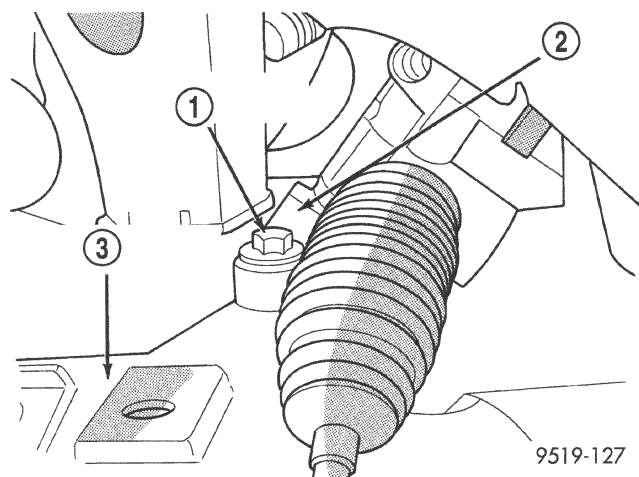
(23) Remove the 2 bolts, at the isolators (Fig. 21) and (Fig. 22) attaching the steering gear assembly to front suspension crossmember. Then remove the 2 bolts attaching the steering gear saddle bracket (Fig. 23) to the front suspension crossmember. Remove the steering gear assembly from the front suspension crossmember.



**Fig. 21 Steering Gear Rear Mounting Isolator Bolt**

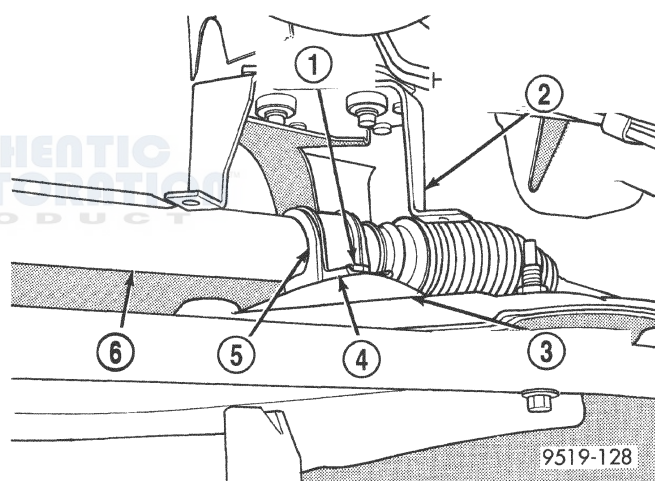
- 1 - REAR MOUNTING BOLT
- 2 - STEERING GEAR
- 3 - FRONT SUSPENSION CROSSMEMBER

(24) Transfer required parts from removed steering gear assembly to the replacement steering gear, if a new steering gear is being installed.



**Fig. 22 Steering Gear Front Mounting Bolt**

- 1 - FRONT MOUNTING BOLT
- 2 - STEERING GEAR
- 3 - FRONT SUSPENSION CROSSMEMBER



**Fig. 23 Steering Gear Saddle Bracket Mounting Bolts**

- 1 - ATTACHING BOLTS (2)
- 2 - SUPPORTED ANTILOCK BRAKES HYDRAULIC CONTROL UNIT
- 3 - FRONT SUSPENSION CROSSMEMBER
- 4 - SADDLE BRACKET
- 5 - ISOLATOR
- 6 - STEERING GEAR

**INSTALLATION**

(1) Install steering gear assembly on front suspension crossmember. Install the 2 long steering gear assembly to front crossmember mounting bolts (Fig. 21) and (Fig. 22) into the mounting isolators. Then install the 2 short bolts (Fig. 23) into the saddle bracket. Tighten the 4 steering gear mounting bolts to a torque of 68 N·m (50 ft. lbs.).



**REMOVAL AND INSTALLATION (Continued)**

(2) Install the power steering fluid pressure and return lines on the ports of the power steering gear (Fig. 20). Tighten power steering fluid pressure and return lines to steering gear tube nuts (Fig. 20) to a torque of 31 N·m (275 in. lbs.).

(3) Using transmission jack, raise front suspension crossmember and steering gear against body of vehicle. Start the 2 rear bolts (Fig. 19) into tapping plates, attaching front suspension crossmember to body of vehicle. Then install the 2 front bolts, (Fig. 19) attaching front suspension crossmember to frame rails of vehicle. Tighten the 4 mounting bolts evenly, until front suspension crossmember is against body of vehicle at the 4 mounting points. Then torque the 4 mounting bolts to 2 N·m (20 in. lbs.) to hold front suspension crossmember in position.

**CAUTION: When front suspension crossmember is installed back in vehicle, crossmember MUST be aligned with positioning marks previously scribed into body of vehicle. This MUST be done to maintain NET BUILD front suspension alignment settings.**

(4) Using a soft face hammer, tap front suspension crossmember into position, until it is aligned with the previously scribed positioning marks on body of vehicle (Fig. 11), (Fig. 12) and (Fig. 13). When front suspension crossmember is correctly positioned, torque the 2 rear crossmember mounting bolts to 163 N·m (120 ft. lbs.). Then torque the 2 front crossmember to frame rail attaching bolts to 163 N·m (120 ft. lbs.).

(5) Install the engine support bracket on the front of the front suspension crossmember (Fig. 16). Install the 2 support bracket to suspension crossmember attaching bolts and tighten to a torque of 75 N·m (55 ft. lbs.).

(6) Install bolt (Fig. 18) attaching engine support bracket to transaxle mounting bracket. Tighten bolt to a torque of 75 N·m (55 ft. lbs.).

(7) Install the 2 bolts attaching the rear support bracket, for the under engine support bracket (Fig. 17), to the rear of the front suspension crossmember. Tighten bolts to a torque of 75 N·m (55 ft. lbs.).

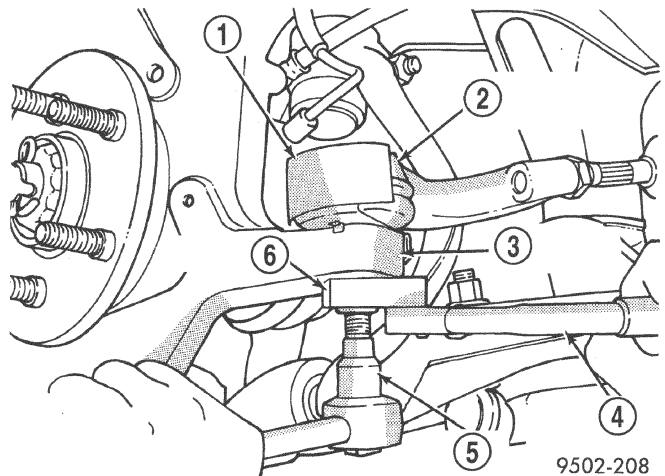
(8) Install vehicle wiring harness connector onto power steering fluid pressure switch on steering gear assembly (Fig. 20). **Be sure locking tab on wiring harness connector is securely latched to pressure switch.**

(9) Install the antilock brakes hydraulic control unit mounting bracket on the front suspension crossmember. Install the 3 mounting bracket to crossmember attaching bolts and tighten to a torque of 28 N·m (250 in. lbs.).

(10) Loosely install the 2 shock absorber clevis to lower control arm attaching nuts and bolts (Fig. 15).

(11) Install tie rod seal boot heat shield on tie rod end (Fig. 10).

(12) Install tie rod end into steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 10). Then using a crowfoot and 11/32 socket, torque tie rod end attaching nut to 61 N·m (45 ft. lbs.) (Fig. 24).



**Fig. 24 Torquing Tie Rod End Attaching Nut**

- 1 - HEAT SHIELD
- 2 - TIE ROD END
- 3 - STEERING KNUCKLE
- 4 - TORQUE WRENCH
- 5 - 11/32 SOCKET
- 6 - CROWFOOT

(13) Install and tighten the 2 stabilizer bar bushing clamp to body attaching bolts (Fig. 14).

**CAUTION: When supporting lower control arm with jack stand, do not position jack stand under the ball joint cap on the lower control arm. Position in area of lower control arm shown in (Fig. 25).**

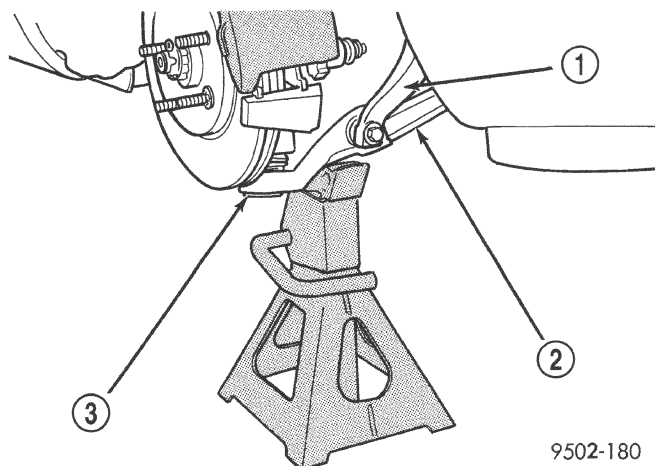
(14) Lower vehicle to the ground with a jack stand positioned under the lower control arm (Fig. 25). Continue to lower vehicle so the total weight of the vehicle is supported by the jack stand and lower control arm.

(15) Tighten the shock absorber clevis to lower control arm bushing thru-bolt to a torque of 92 N·m (68 ft. lbs.).

(16) Install the wheel and tire assemblies back on vehicle. Tighten the wheel nuts in proper sequence to a torque of 129 N·m (95 ft. lbs.) (Fig. 15).



## REMOVAL AND INSTALLATION (Continued)



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**Fig. 25 Lower Control Arm Correctly Supported By Jack Stand**

- 1 - SHOCK ABSORBER CLEVIS
- 2 - LOWER CONTROL ARM
- 3 - BALL JOINT CAP

**CAUTION:** Before connecting the steering column intermediate shaft coupler to the steering gear shaft, position the front wheels **STRAIGHT-AHEAD**. The steering wheel must also be in the centered position.

(17) Under the instrument panel, reconnect the intermediate shaft to the steering gear shaft. To do so, perform one of the following that applies:

(a) On early production vehicles, reconnect the steering column intermediate shaft to the steering gear shaft (Fig. 7). Install a **new** intermediate shaft coupler pinch bolt through the coupler and into its nut, then tighten the nut and pinch bolt to a torque of 27 N·m (240 in. lbs.).

(b) On later production vehicles, align the flats and slide the intermediate shaft onto the steering gear shaft aligning the pinch bolt hole with the notch formed into the steering gear shaft. Install a **new** pinch bolt in the intermediate shaft coupler (Fig. 8), then tighten the pinch bolt to a torque of 34 N·m (300 in. lbs.).

(18) On early production vehicles, install a **new** "E" clip on the end of the pinch bolt (Fig. 7).

(19) Remove the steering wheel holder.

**CAUTION:** Do not use automatic transmission fluid in place of power steering fluid.

(20) Fill power steering pump fluid reservoir to the (Full-Cold) proper level.

(21) Start the engine and let it run for a few seconds to circulate the fluid.

(22) Turn the engine off.

(23) Add fluid if necessary.

(24) Raise front wheels of vehicle off the ground.

(25) Start engine and turn steering wheel several times from stop-to-stop to bleed air from fluid in system. Stop engine, check fluid level, and inspect system for leaks. **Fill pump reservoir to correct level with Mopar®, Power Steering Fluid, or equivalent.** See Checking Fluid Level.

(26) Lower front wheels of vehicle back on the ground.

**CAUTION:** During this procedure do not allow the steering gear inner tie rod boots to become twisted. (See Wheel Alignment in the suspension section of this service manual).

(27) Check front alignment and adjust the front Toe setting on the vehicle. Refer to the Toe Setting Procedure in Front Suspension Service Procedures in this group of the service manual. Refer to the Specifications Section at the end of this group for the desired front Toe specification.

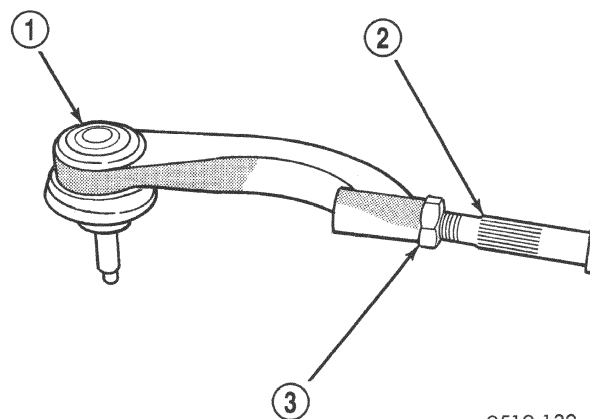
(28) Tighten tie rod jam nut to 74 N·m (55 ft. lbs.) torque.

(29) Adjust steering gear to tie rod boots at tie rods.

## OUTER TIE ROD END

## DISASSEMBLE

(1) Loosen inner tie rod to outer tie rod jam nut (Fig. 26).



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**Fig. 26 Inner To Outer Tie Rod Jam Nut**

- 1 - OUTER TIE ROD
- 2 - INNER TIE ROD
- 3 - JAM NUT

(2) Remove nut attaching outer tie rod end to steering knuckle (Fig. 27). **Nut is to be removed from tie rod end using the following procedure, hold tie rod end stud with a 11/32 socket while loosening and removing nut with wrench.**

## REMOVAL AND INSTALLATION (Continued)

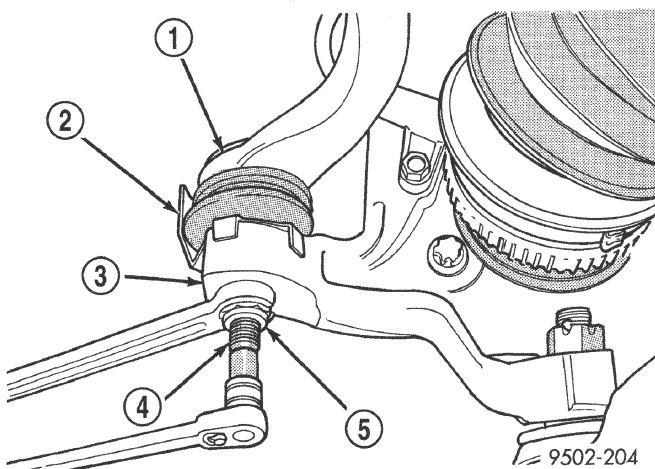


Fig. 27 Removing Tie Rod End Nut

- 1 - TIE ROD END
- 2 - HEAT SHIELD
- 3 - STEERING KNUCKLE
- 4 - TIE ROD END STUD
- 5 - NUT

(3) Remove tie rod end stud, from steering knuckle, using Remover, Special Tool MB-991113 (Fig. 28).

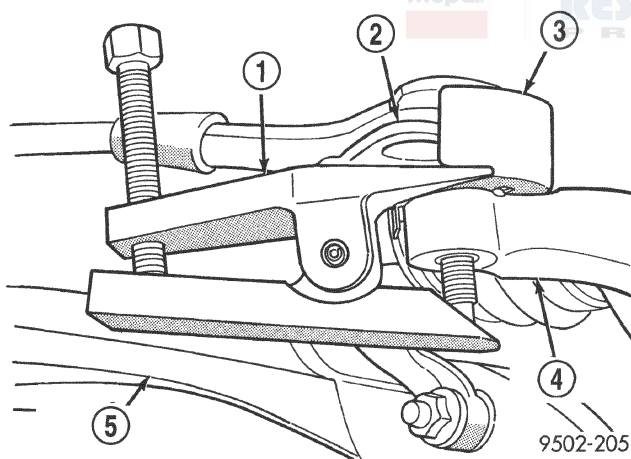


Fig. 28 Tie Rod End Removal From Steering Knuckle

- 1 - SPECIAL TOOL MB-991113
- 2 - TIE ROD END
- 3 - HEAT SHIELD
- 4 - STEERING KNUCKLE
- 5 - LOWER CONTROL ARM

(4) Remove outer tie rod end from inner tie rod by un-threading it from the inner tie rod.

## ASSEMBLE

(1) Install outer tie rod onto inner tie rod. **Make sure jam nut is on inner tie rod.**

(2) Do not tighten jam nut.

(3) Install tie rod end seal boot heat shield (Fig. 27) on the tie rod end.

(4) Install tie rod end into the steering knuckle. Start tie rod end to steering knuckle attaching nut onto stud of tie rod end. While holding stud of tie rod end stationary, tighten tie rod end to steering knuckle attaching nut (Fig. 27). Then using a crow-foot and 11/32 socket, (Fig. 29) torque tie rod end attaching nut to 61 N·m (45 ft. lbs.).

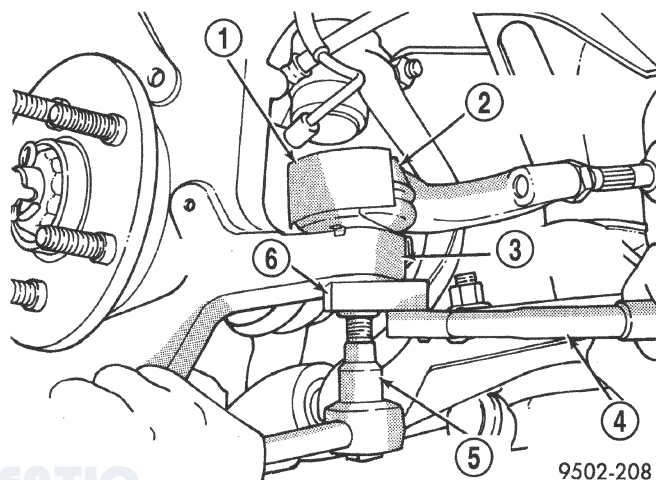


Fig. 29 Torquing Tie Rod End Attaching Nut

- 1 - HEAT SHIELD
- 2 - TIE ROD END
- 3 - STEERING KNUCKLE
- 4 - TORQUE WRENCH
- 5 - 11/32 SOCKET
- 6 - CROWFOOT

**CAUTION:** During this procedure do not allow the steering gear boot to become twisted. (See Wheel Alignment in the suspension section of this service manual).

(5) Adjust the front Toe setting on the vehicle. Refer to the Toe Setting Procedure in Front Suspension Service Procedures in this group of the service manual. Refer to the Specifications Section at the end of this group for the desired front Toe specification.

(6) Tighten tie rod jam nut (Fig. 26) to 75 N·m (55 ft. lbs.) torque.

(7) Adjust the steering gear to inner tie rod boots at inner tie rod if they became twisted during Toe adjustment.

## DISASSEMBLY AND ASSEMBLY

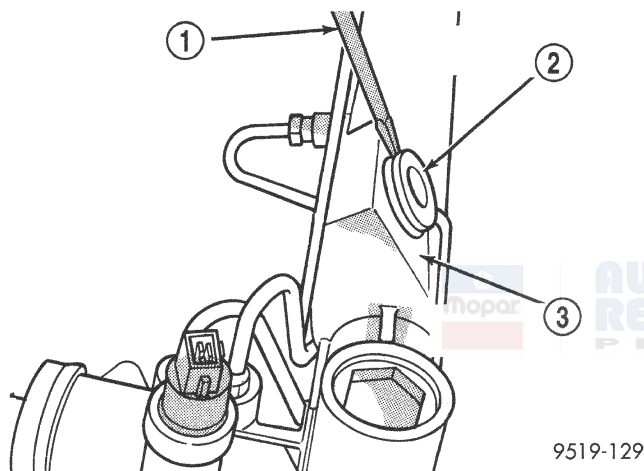
### POWER STEERING GEAR MOUNTING BOLT ISOLATOR

The removal and installation of the mounting bolt isolator must be performed with the steering gear assembly removed from the vehicle.

The steering gear mounting bolt isolators (Fig. 30) are a serviceable component of the steering gear assembly. Both isolator bushing are serviced using the same procedure listed below but only the rear mounting bushing is shown.

#### DISASSEMBLY

(1) Using a screwdriver, pry the sleeve out of the mounting bolt isolator (Fig. 30).



**Fig. 30 Mounting Bolt Isolator Sleeve Removal**

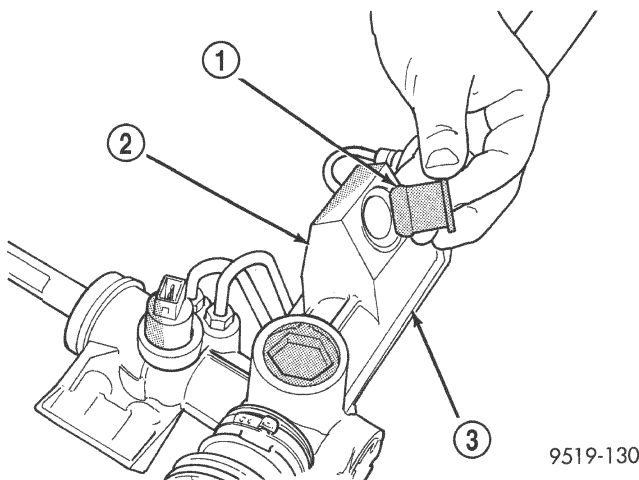
- 1 - SCREWDRIVER
- 2 - ISOLATOR BUSHING SLEEVE
- 3 - STEERING GEAR MOUNTING BRACKET

(2) Pry the mounting bolt isolator bushing from the steering gear mounting bracket.

#### ASSEMBLY

(1) Lubricate replacement mounting bolt isolator bushing using Mopar, Silicone Spray Lube or an equivalent.

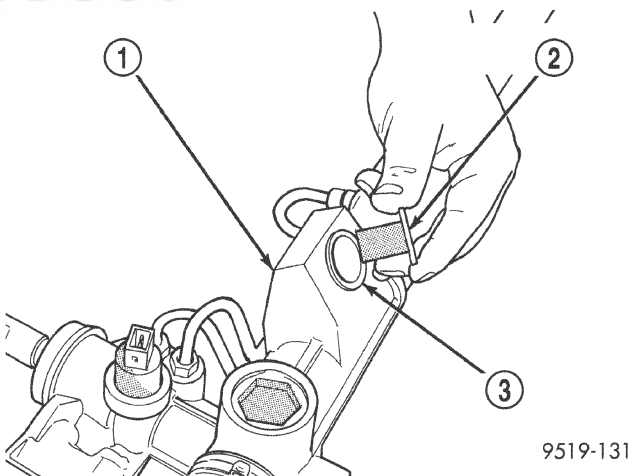
(2) Install the mounting bolt isolator bushing into the steering gear mounting bracket from the bottom side of the bracket (Fig. 31).



**Fig. 31 Installing Mounting Bolt Isolator Bushing**

- 1 - STEERING GEAR MOUNTING BOLT ISOLATOR BUSHING
- 2 - STEERING GEAR MOUNTING BRACKET
- 3 - STEERING GEAR

(3) Install mounting bolt isolator bushing sleeve into isolator bushing by pressing the sleeve into the bushing by hand (Fig. 32).

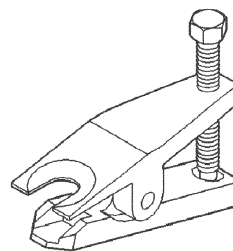


**Fig. 32 Mounting Bolt Isolator Sleeve Installation**

- 1 - STEERING GEAR MOUNTING BRACKET
- 2 - ISOLATOR BUSHING SLEEVE
- 3 - STEERING GEAR MOUNTING BOLT ISOLATOR BUSHING

**SPECIFICATIONS****STEERING GEAR FASTENER TORQUE SPECIFICATIONS**

DESCRIPTION	TORQUE
<b>STEERING GEAR:</b>	
To Crossmember Bolts . . . . .	68 N·m (50 ft. lbs.)
Tie Rod To Steering Knuckle Nut . . . . .	61 N·m (45 ft. lbs.)
Outer To Inner Tie Rod Jam Nut . . . . .	75 N·m (55 ft. lbs.)
Power Steering Hose Tube Nuts . . . . .	31 N·m (275 in. lbs.)

**SPECIAL TOOLS****POWER STEERING GEAR**

8011086f

***Remover Tie Rod End MB-991113*****AUTHENTIC  
RESTORATION™  
PRODUCT**



STEERING COLUMN

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DESCRIPTION AND OPERATION

STEERING COLUMN

DESCRIPTION

The steering column used in this vehicle is a tilt type (Fig. 1). It has been designed to be serviced only as an assembly if it is determined to be defective. The replaceable components mounted on the steering column assembly are the key cylinder, ignition switch, multi-function switch, clockspring, speed control switches, lock cylinder trim ring, SKIM module, trim shrouds, driver airbag and steering wheel. These replaceable components of the steering column can be serviced without requiring removal of the steering column from the vehicle. The steering column intermediate shaft can also be serviced separately from the steering column.

OPERATION

Turning of the steering wheel is transferred through the steering column and intermediate shaft, to the power steering gear pinion shaft. The gear then moves the steering knuckles, steering the vehicle.

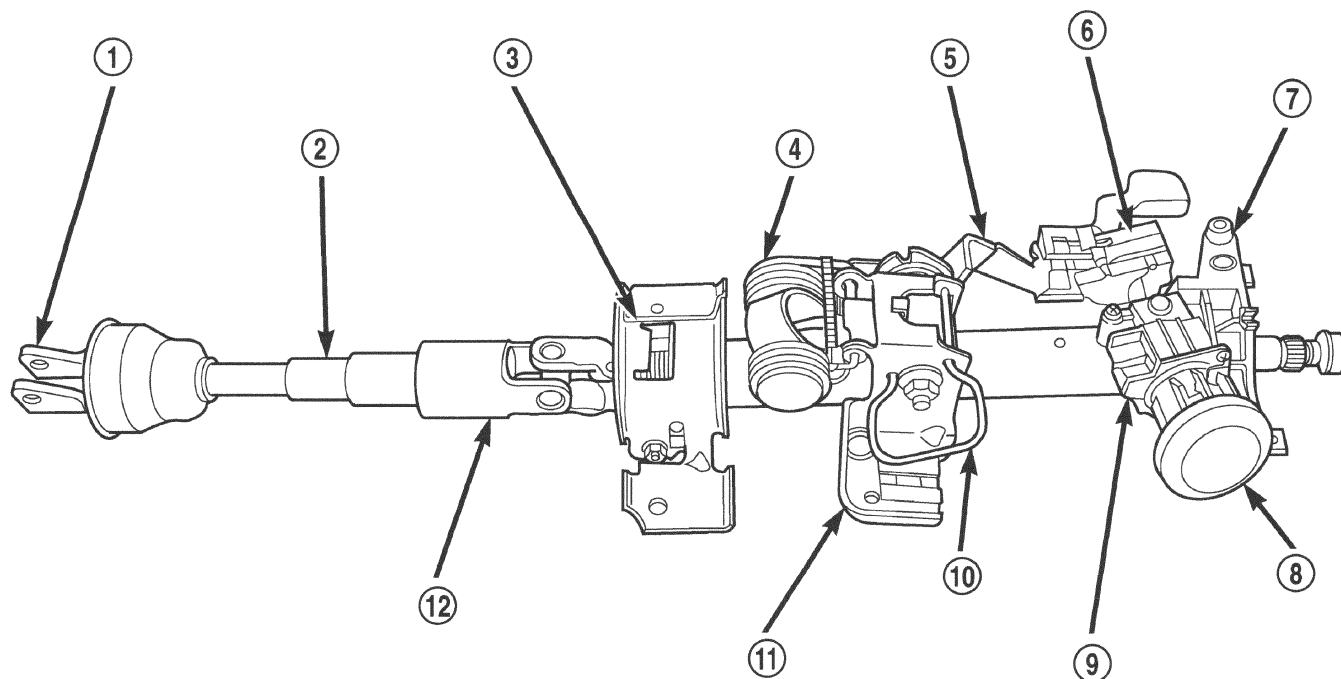
STEERING COLUMN INTERMEDIATE SHAFT

DESCRIPTION

The steering column intermediate shaft is located between the steering column and the power steering gear. It has a flexible joint at each end. Later models have a slider stage in the center portion of the shaft. The steering column intermediate shaft fastens to the steering column's splined shaft using a roll pin. Depending on whether it is an early or later production model vehicle, the connection to the power steering gear differs. Early models use a intermediate shaft with a slap coupler connection at the steering gear pinion shaft (Fig. 2). Later models use a slider-stage style intermediate shaft (Fig. 3). The two intermediate shafts are not interchangeable because of the steering gear's pinion shaft shape. Both early and later shafts use a pinch bolt to secure the shafts to one another at the steering gear.

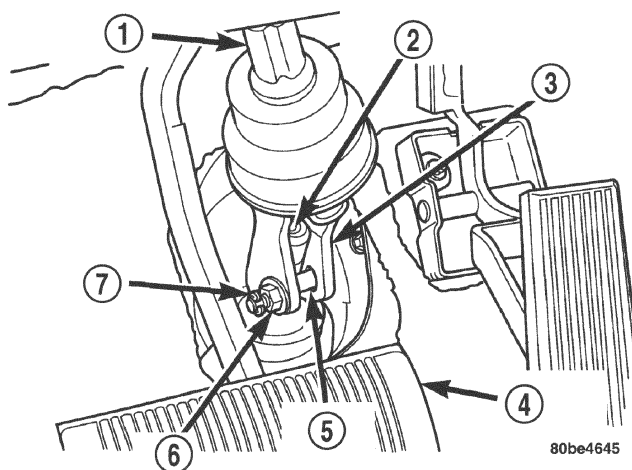
OPERATION

The steering column intermediate shaft connects the steering column shaft to the power steering gear's pinion shaft. It's flexible joints allow the shaft to flex when rotating.

**DESCRIPTION AND OPERATION (Continued)****Fig. 1 Steering Column**

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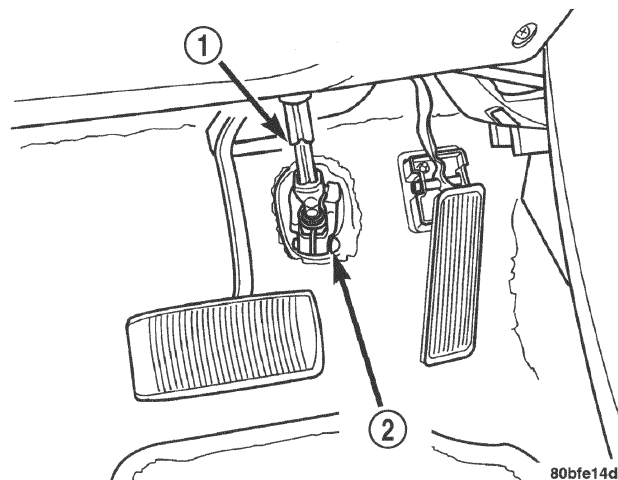
- |  |   |
|--|---|
| 1 - INTERMEDIATE SHAFT COUPLER             | 7 - SWITCH HOUSING                          |
| 2 - INTERMEDIATE SHAFT                     | 8 - TRIM RING                               |
| 3 - LOWER STEERING COLUMN MOUNTING BRACKET | 9 - LOCK CYLINDER HOUSING                   |
| 4 - TILT TORSION SPRING                    | 10 - SHIPPING PIN                           |
| 5 - TILT LEVER                             | 11 - STEERING COLUMN UPPER MOUNTING BRACKET |
| 6 - IGNITION SWITCH                        | 12 - INTERMEDIATE SHAFT FLEX JOINT          |



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**Fig. 2 Slap Coupler Intermediate Shaft**

- |                         |
|-------------------------|
| 1 - INTERMEDIATE SHAFT  |
| 2 - STEERING GEAR SHAFT |
| 3 - COUPLER             |
| 4 - BRAKE PEDAL         |
| 5 - PINCH BOLT          |
| 6 - NUT                 |
| 7 - "E" CLIP            |



80bfe14d

**Fig. 3 Slider-Stage Intermediate Shaft**

- |                        |
|------------------------|
| 1 - INTERMEDIATE SHAFT |
| 2 - PINCH BOLT         |

## DIAGNOSIS AND TESTING

### STEERING COLUMN

For diagnosis of conditions relating to the steering column, refer to the STEERING SYSTEM DIAGNOSIS CHARTS in DIAGNOSIS AND TESTING in the POWER STEERING section of this service manual group.

### STEERING COLUMN INTERMEDIATE SHAFT

The steering column intermediate shaft and its flexible joint couplers (Fig. 1) must be inspected whenever any of the following conditions exist:

- After the vehicle has been involved in a collision which deploys the airbag, regardless of the extent of damage done to the vehicle.
- After the vehicle has been involved in an undercarriage impact which results in any type of damage to the front suspension crossmember.
- Under any conditions which result in the steering column assembly or steering column shaft receiving a force great enough to move the steering column or shaft forward or rearward in a vehicle.

Inspect the intermediate shaft and its flexible joint couplers for any of the following conditions:

- seized or binding bearings
- loose bearing stakes
- bearings not fully seated in the coupler yoke
- bent intermediate shaft

Presence of any of the above faulty conditions call for replacement of the entire steering column intermediate shaft.

## REMOVAL AND INSTALLATION

### SERVICE WARNINGS AND CAUTIONS

**WARNING: BEFORE BEGINNING ANY SERVICE PROCEDURES THAT INVOLVES REMOVING THE AIR BAG. REMOVE AND ISOLATE THE NEGATIVE (-) BATTERY CABLE (GROUND) FROM THE VEHICLE BATTERY. THIS IS THE ONLY SURE WAY TO DISABLE THE AIR BAG SYSTEM. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIR BAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.**

**WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTRO-MECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE, REMOVE OR INSTALL THE AIR BAG SYSTEM COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIR BAG AND POSSIBLE PERSONAL INJURY. THE FASTENERS, SCREWS, AND BOLTS, ORIGINALLY USED FOR THE AIR BAG COMPONENTS, HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIR BAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANYTIME A NEW FASTENER IS NEEDED, REPLACE WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR FASTENERS LISTED IN THE PARTS BOOKS. BEFORE SERVICING A STEERING COLUMN EQUIPPED WITH AN AIR BAG, REFER TO GROUP 8M, ELECTRICAL FOR PROPER AND SAFE SERVICE PROCEDURES.**

**WARNING: SAFETY GOGGLES SHOULD BE WORN AT ALL TIMES WHEN WORKING ON STEERING COLUMNS.**

**CAUTION: Disconnect negative (ground) cable from the battery, before servicing any column component.**

**CAUTION: Do not attempt to remove the pivot pins to disassemble the tilting mechanism. Damage will occur.**

### STEERING COLUMN

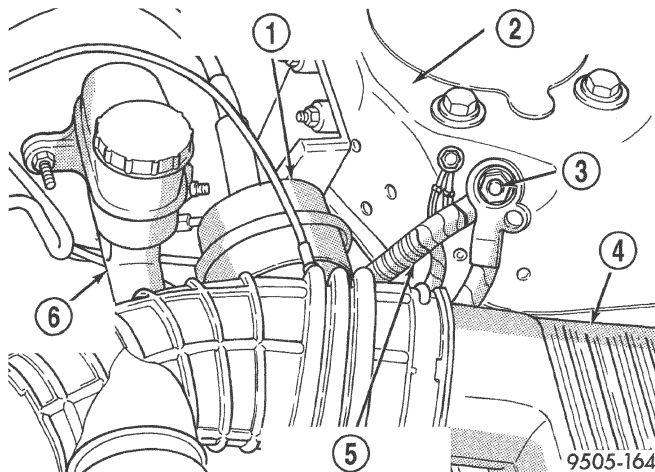
**WARNING: SAFETY GOGGLES SHOULD BE WORN AT ALL TIMES WHEN WORKING ON STEERING COLUMNS.**

### REMOVAL

(1) Remove remote ground cable (Fig. 4) from ground stud on shock tower. Then correctly isolate ground cable from vehicle by installing isolator on stud (Fig. 5).

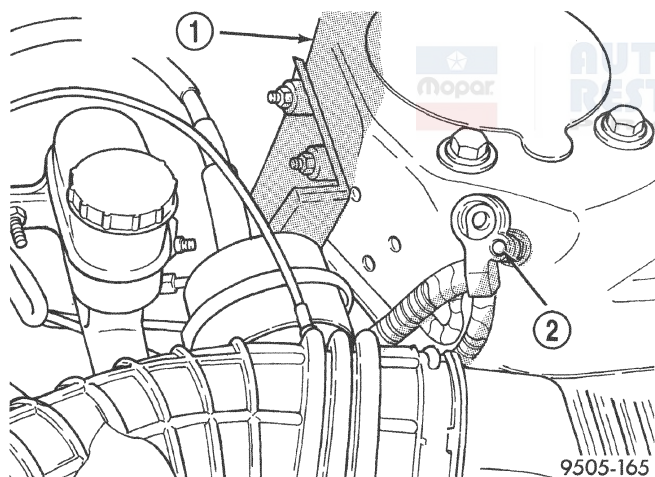


## REMOVAL AND INSTALLATION (Continued)



**Fig. 4 Remote Ground Cable At Shock Tower**

- 1 - SPEED CONTROL SERVO
- 2 - LEFT STRUT TOWER
- 3 - GROUND STUD
- 4 - AIR CLEANER
- 5 - REMOTE GROUND CABLE
- 6 - MASTER CYLINDER



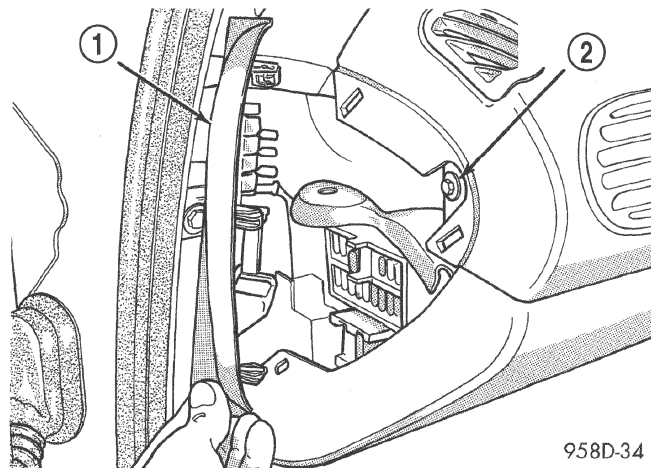
**Fig. 5 Correctly Isolated Remote Ground Cable**

- 1 - LEFT STRUT TOWER
- 2 - GROUND STUD

(2) Wait for a minimum of 2 minutes before starting to remove airbag from steering wheel. This will allow the airbag system capacitor to de-energize.

(3) Before beginning removal of steering column assembly from vehicle, be sure front wheels of vehicle are in the STRAIGHT AHEAD position.

(4) Remove fuse panel cover from left end of instrument panel (Fig. 6). Then remove the screw behind fuse panel cover, attaching the instrument panel top cover (Fig. 6).

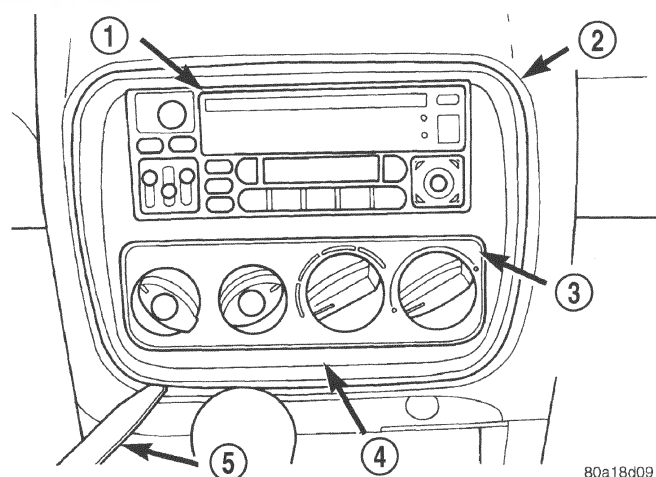


**Fig. 6 Instrument Panel Top Cover Attaching Screw**

- 1 - FUSE PANEL COVER
- 2 - TOP COVER SCREW

**NOTE:** When removing the center bezel, only use a soft tool such as a trim stick (Fig. 7) to pry the center bezel from the dash panel. Use of a hard tool will damage dash panel.

(5) Remove center bezel surrounding radio and climate control panel from top cover of dash panel (Fig. 7).



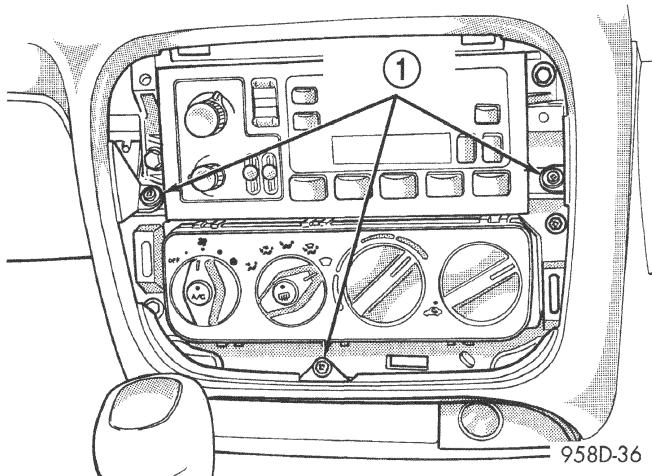
**Fig. 7 Center Bezel**

- 1 - RADIO
- 2 - DASH PANEL
- 3 - CLIMATE CONTROL PANEL
- 4 - CENTER BEZEL
- 5 - TRIM STICK

(6) Remove the 3 screws attaching the top cover to the dash panel (Fig. 8).

(7) Remove the top cover from the dash panel. Removal of the top cover is required to gain access to

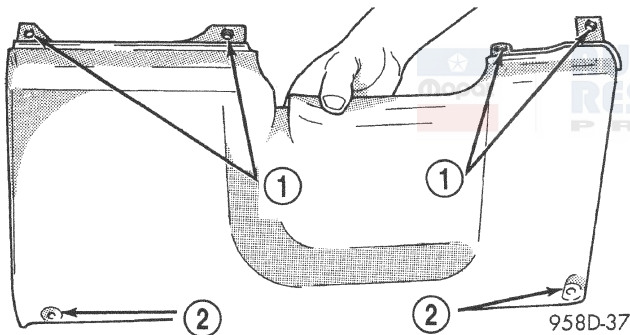


**REMOVAL AND INSTALLATION (Continued)****Fig. 8 Instrument Panel Top Cover Attaching Screws**

1 - TOP COVER SCREWS

the screws (Fig. 9) attaching the top of the knee bolster to the dash panel.

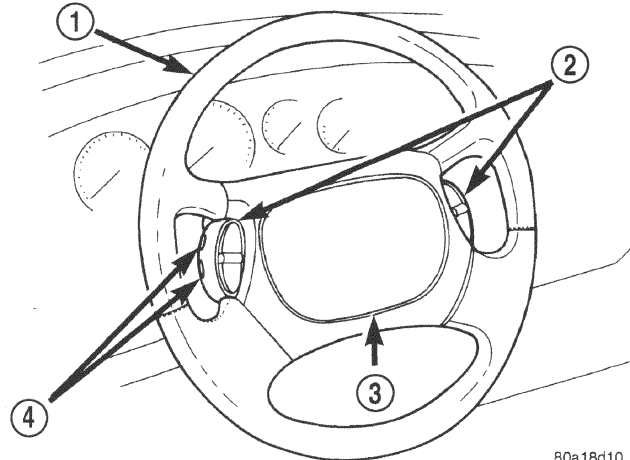
(8) Remove screws attaching the knee bolster to the instrument panel (Fig. 9).

**Fig. 9 Knee Bolster Attaching Screw Locations**

1 - KNEE BOLSTER SCREW LOCATIONS UNDER TOP COVER  
2 - LOWER SCREW LOCATIONS

**WARNING: WHEN AN UNDEPLOYED AIRBAG ASSEMBLY IS TO BE REMOVED FROM THE STEERING WHEEL, DISCONNECT BATTERY GROUND CABLE AND ISOLATE. ALLOW SYSTEM CAPACITOR TO DISCHARGE FOR TWO MINUTES, THEN BEGIN AIRBAG REMOVAL.**

(9) Remove the speed control switches (Fig. 10) from the steering wheel. The speed control switches are mounted to the steering wheel using 2 mounting screws in the side of each speed control switch (Fig. 10).

**Fig. 10 Speed Control Switches**

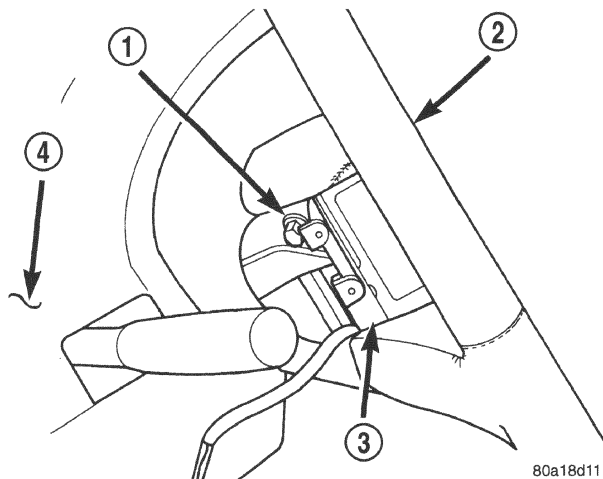
1 - STEERING WHEEL  
2 - SPEED CONTROL SWITCHES  
3 - AIRBAG  
4 - MOUNTING SCREWS

(10) Remove both speed control switches from the wiring harness in the steering wheel.

**WARNING: WHEN HANDLING AN UNDEPLOYED AIRBAG MODULE DURING SERVICING OF THE STEERING COLUMN THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED. AT NO TIME SHOULD ANY SOURCE OF ELECTRICITY BE PERMITTED NEAR THE INFLATOR ON THE BACK OF THE AIRBAG MODULE. WHEN CARRYING A LIVE MODULE, THE TRIM COVER SHOULD BE POINTED AWAY FROM THE BODY TO MINIMIZE INJURY IF MODULE ACCIDENTLY DEPLOYS. IF AIRBAG MODULE IS PLACED ON A BENCH OR OTHER SURFACE, PLASTIC COVER SHOULD BE FACE UP TO MINIMIZE MOVEMENT IN CASE OF ACCIDENTAL DEPLOYMENT.**

## REMOVAL AND INSTALLATION (Continued)

(11) Remove the 2 bolts, 1 on each side of the steering wheel, attaching the airbag module to the steering wheel (Fig. 11).

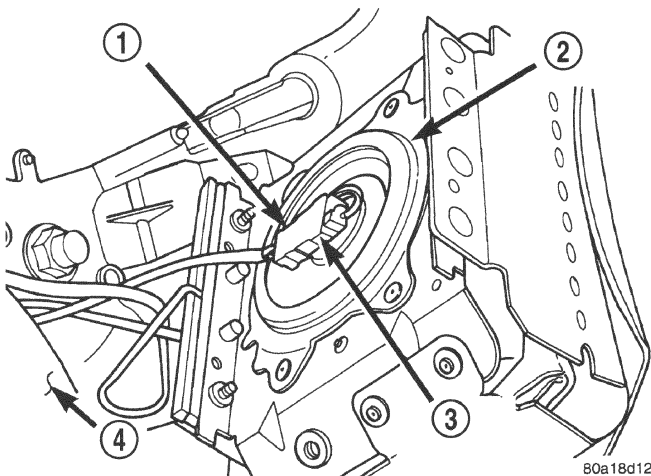


**Fig. 11 Airbag Module Attaching Bolts**

- 1 - ATTACHING BOLT
- 2 - STEERING WHEEL
- 3 - AIRBAG MODULE
- 4 - STEERING COLUMN

(12) Remove the airbag module from the center of the steering wheel.

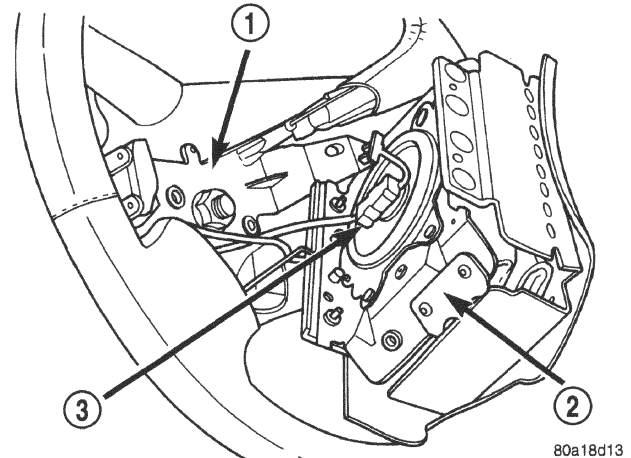
(13) Remove the locking tab from clockspring airbag electrical lead connector (Fig. 12). Locking tab is removed by pulling it straight out of the airbag connector. **Do not twist the locking tab when removing it from the connector.**



**Fig. 12 Airbag Module Electrical Lead Locking Tab**

- 1 - ELECTRICAL LEAD CONNECTOR
- 2 - AIRBAG MODULE
- 3 - LOCKING TAB
- 4 - STEERING WHEEL

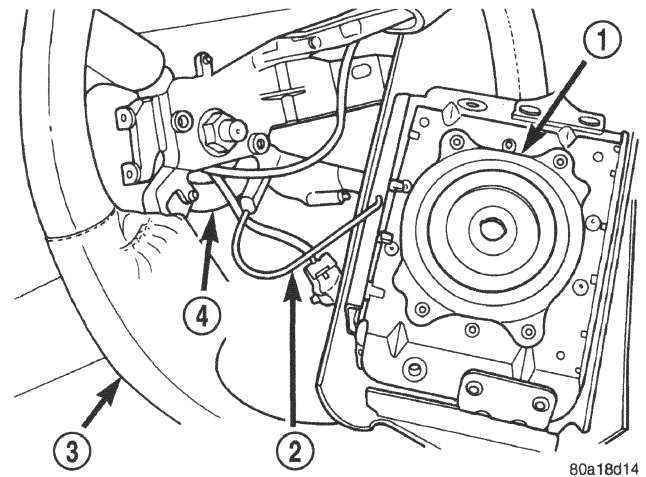
(14) Disconnect the electrical connector (Fig. 13) from the back of the airbag module. Connector is removed by pulling it straight out of the airbag module. **Do not twist the connector when removing it from the airbag.**



**Fig. 13 Airbag Module Electrical Lead Connector**

- 1 - STEERING WHEEL
- 2 - AIRBAG MODULE
- 3 - ELECTRICAL LEAD CONNECTOR

(15) Remove the wiring lead for the horn switch in the airbag module (Fig. 14) from the wiring lead coming from the clockspring.



**Fig. 14 Horn Switch Wiring Lead**

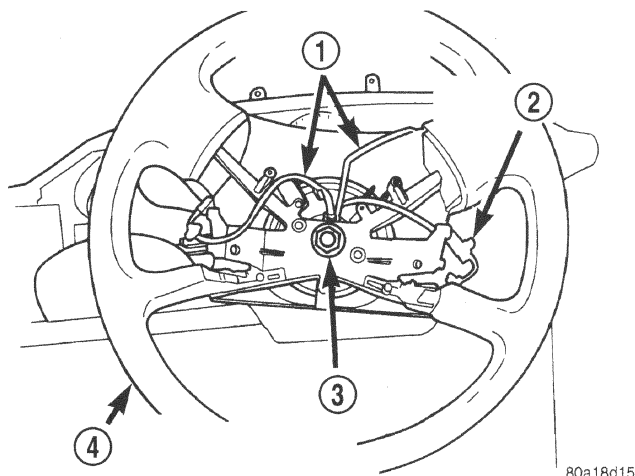
- 1 - AIRBAG MODULE
- 2 - HORN SWITCH WIRING LEAD
- 3 - STEERING WHEEL
- 4 - CLOCKSPring

(16) Turn the lock cylinder to the OFF position and remove the key from the lock cylinder.

(17) Turn the steering wheel to the left 1/2 a turn (180°) (Fig. 15) until the steering column lock is engaged.

**REMOVAL AND INSTALLATION (Continued)**

(18) Remove the steering wheel attaching nut (Fig. 15) from the steering column shaft.

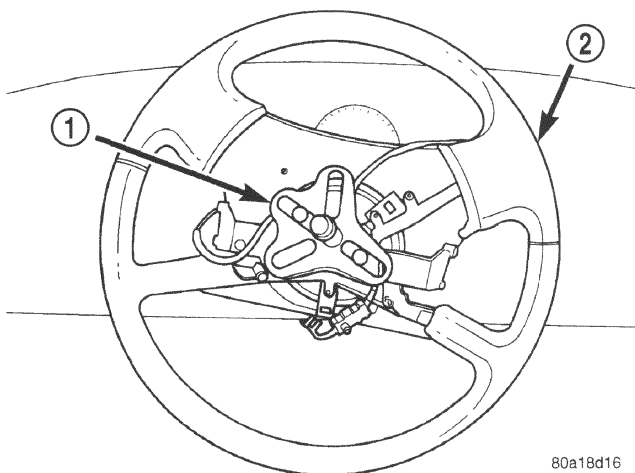


**Fig. 15 Steering Wheel Attaching Nut**

- 1 - SPEED CONTROL SWITCH WIRING
- 2 - AIRBAG ELECTRICAL LEAD
- 3 - STEERING WHEEL ATTACHING NUT
- 4 - STEERING WHEEL (SHOWN IN LOCKED POSITION)

**CAUTION:** When installing wheel puller on steering wheel, be sure puller bolts are fully seated in the threaded holes in the steering wheel. If bolts are not fully seated in the threaded holes, threads may be stripped out when removing the steering wheel.

(19) Install a steering wheel puller on the steering wheel (Fig. 16).



**Fig. 16 Puller Installed On Steering Wheel**

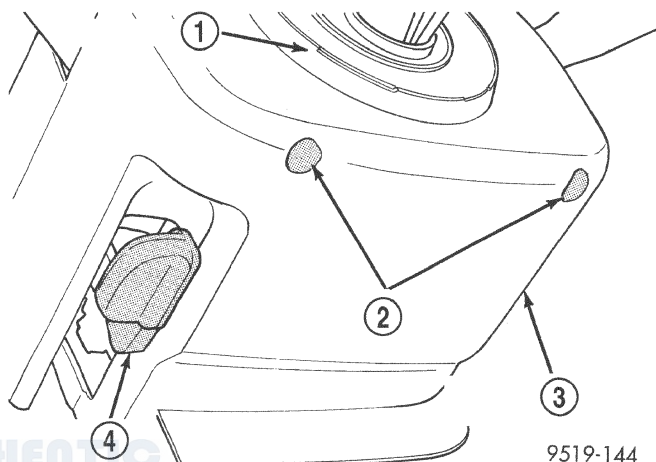
- 1 - STEERING WHEEL PULLER
- 2 - STEERING WHEEL

**CAUTION:** Do not bump or hammer on steering wheel or steering column shaft when removing steering wheel from steering column.

**CAUTION:** Do not bump or hammer on steering wheel or steering column shaft when removing steering wheel from steering column.

(20) Remove the steering wheel using the puller.

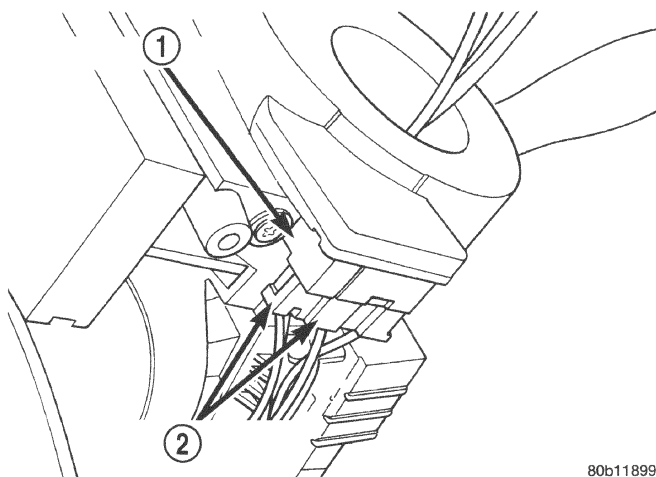
(21) Remove the 2 screws attaching the upper and lower shrouds to the steering column (Fig. 17). First remove upper shroud from steering column, then release tilt lever and tilt steering column to its highest point. Then remove lower shroud from steering column.



**Fig. 17 Steering Column Shroud Attaching Screws**

- 1 - CLOCKSPrING
- 2 - ATTACHING SCREWS
- 3 - STEERING COLUMN SHROUDS
- 4 - TILT LEVER

(22) Remove the 2 wiring harness connectors from the clockspring (Fig. 18).



**Fig. 18 Wiring Harness Connection To Clock Spring**

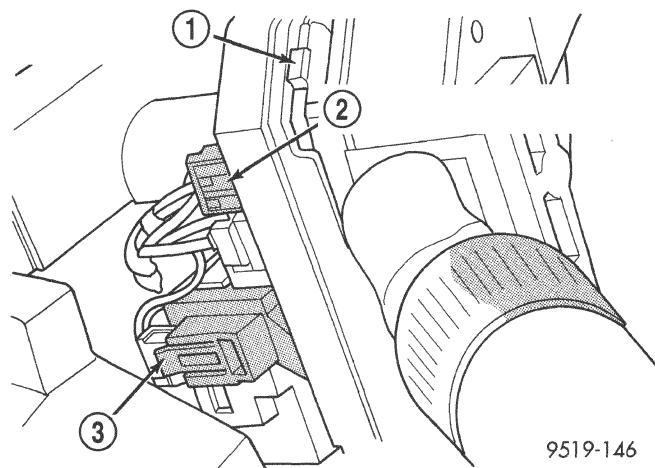
- 1 - CLOCKSPrING
- 2 - WIRING HARNESS CONNECTORS



## REMOVAL AND INSTALLATION (Continued)

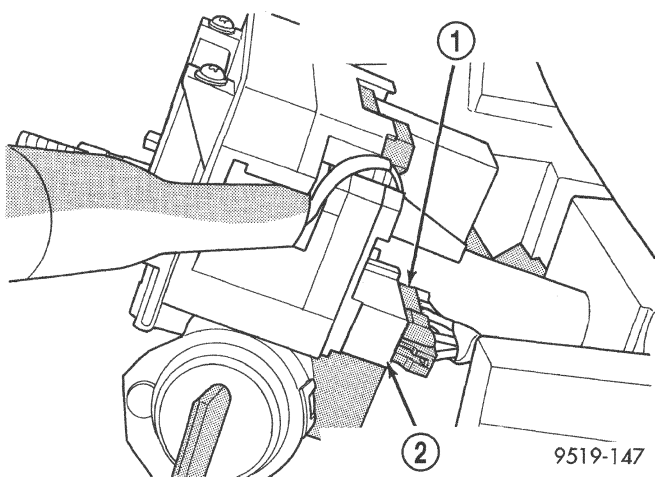
(23) Remove the trim ring for the key cylinder from the lock cylinder housing.

(24) Remove the 2 wire wiring harness connectors from the back of the ignition switch (Fig. 19). Then remove the 2 wiring harness connector from the multi function switch (Fig. 19) and (Fig. 20).



**Fig. 19 Wiring Harness Connections To Ignition And Multi-Function Switch**

- 1 - MULTI-FUNCTION SWITCH
- 2 - MULTI-FUNCTION SWITCH WIRING HARNESS CONNECTOR
- 3 - IGNITION SWITCH

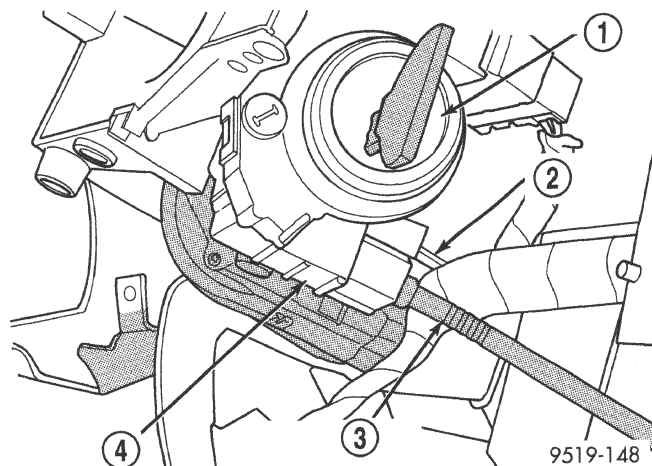


**Fig. 20 Wiring Harness Connection To Multi-Function Switch**

- 1 - MULTI-FUNCTION SWITCH WIRING HARNESS CONNECTOR
- 2 - MULTI-FUNCTION SWITCH

(25) Depress the locking tab on the shifter/ignition interlock cable (Fig. 21) and remove the cable from the key lock housing.

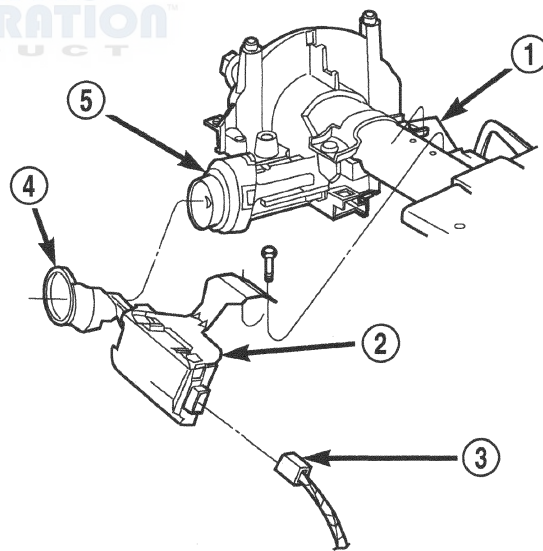
(26) Remove routing clip holding wiring harness to jacket of steering column.



**Fig. 21 Shifter/Ignition Cable At Lock Cylinder Housing**

- 1 - KEY CYLINDER
- 2 - LOCKING TAB
- 3 - SHIFTER IGNITION INTERLOCK CABLE
- 4 - KEY LOCK HOUSING

(27) If equipped with the optional Sentry Key Immobilizer System, remove the SKIM module from the steering column (Fig. 22).



**Fig. 22 Sentry Key Immobilizer Module**

- 1 - STEERING COLUMN
- 2 - SENTRY KEY IMMOBILIZER MODULE
- 3 - SKIM CONNECTOR
- 4 - ANTENNA
- 5 - IGNITION KEY CYLINDER

(28) Under the instrument panel, disconnect the intermediate shaft from the steering gear shaft. To do so, perform one of the following that applies:

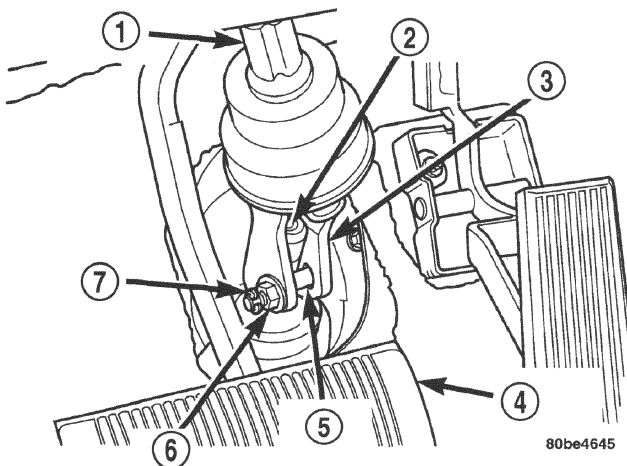
- (a) On early production vehicles, remove the "E" clip from the steering column intermediate shaft



**REMOVAL AND INSTALLATION (Continued)**

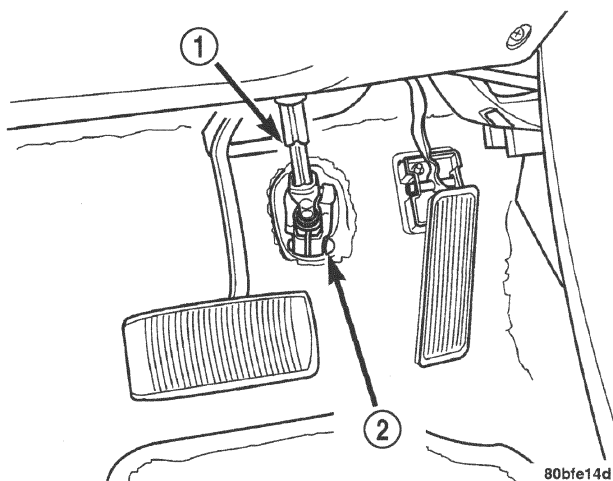
coupler pinch bolt (Fig. 23). Next, remove the pinch bolt from the intermediate shaft coupler by backing off the nut, then separate the intermediate shaft from steering gear shaft.

(b) On later production vehicles, remove the pinch bolt from the intermediate shaft coupler (Fig. 24), then slide the intermediate shaft up and off the steering gear shaft.



**Fig. 23 Early Intermediate Shaft Attachment**

- 1 - INTERMEDIATE SHAFT
- 2 - STEERING GEAR SHAFT
- 3 - COUPLER
- 4 - BRAKE PEDAL
- 5 - PINCH BOLT
- 6 - NUT
- 7 - "E" CLIP

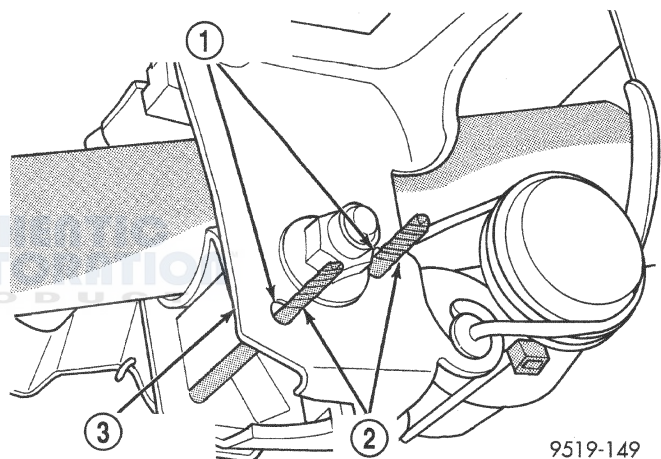


**Fig. 24 Later Intermediate Shaft Attachment**

- 1 - INTERMEDIATE SHAFT
- 2 - PINCH BOLT

**CAUTION:** Before loosening the upper and lower steering column mounting bracket attaching nuts, the following procedure to lock upper steering column mounting bracket from moving must be done. If upper steering column mounting bracket is not locked in its proper position before loosening the mounting nuts, the tilt steering column will not operate correctly when installed back in car. This is due to the alignment of the upper mounting bracket assembly slipping when the mounting bolts are loosened.

(29) Place steering column so it is positioned in the middle of its tilt range. Place the steering column assembly tilt lever in its fully locked position. Then insert a 5/32 inch drill bit in each locking pin hole on the upper steering column mounting bracket (Fig. 25).



**Fig. 25 Locking Pins Installed In Steering Column Bracket**

- 1 - LOCKING PIN HOLES
- 2 - DRILL BITS
- 3 - UPPER MOUNTING BRACKET

(30) Remove the 2 upper steering column assembly mounting bracket to support bracket nuts. Then remove the 2 lower steering column assembly mounting bracket to support bracket nuts (Fig. 26).

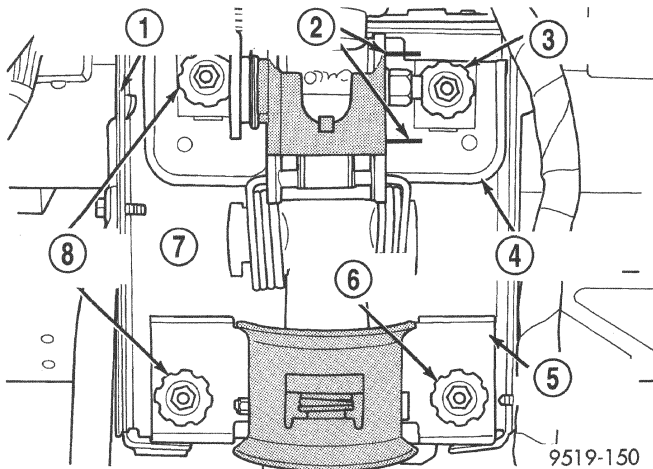
(31) Remove steering column assembly from vehicle through the drivers door of the passenger compartment. Use care to avoid damaging the paint or interior trim.

**INSTALLATION**

(1) Install steering column on the studs in the steering column support bracket. Loosely install the 4 steering column assembly attaching nuts.

(2) Tighten the 2 lower steering column assembly mounting nuts (Fig. 26) to hold the steering column in place. Be sure both breakaway capsules are still

## REMOVAL AND INSTALLATION (Continued)



**Fig. 26 Steering Column Upper And Lower Mounting Bracket Nuts**

- 1 - STEERING COLUMN SUPPORT BRACKET
- 2 - DRILL BITS
- 3 - MOUNTING NUT
- 4 - UPPER MOUNTING BRACKET
- 5 - LOWER MOUNTING BRACKET
- 6 - MOUNTING NUT
- 7 - TILT LEVER
- 8 - MOUNTING NUTS

fully seated in the slots of the upper steering column mounting bracket and the mounting studs are centered for and aft in the plastic capsules (Fig. 27). Then equally tighten both steering column upper mounting nuts, (Fig. 26) until upper steering column mounting bracket is seated against support bracket. Tighten the 4 steering column bracket to support bracket nuts to 17 N·m (150 in. lbs.).

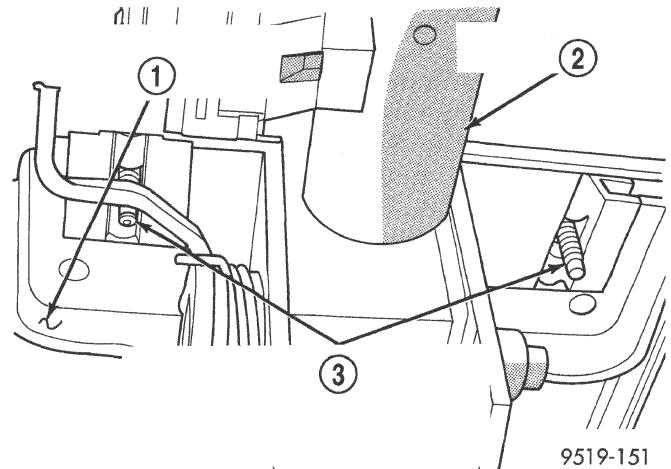
**CAUTION:** Be sure drill bits are removed from steering column upper mounting bracket.

(3) Remove the 2 drill bits (Fig. 25) from the steering column upper mounting bracket. **If a new steering column is being installed in the vehicle, remove the shipping pin from steering column upper mounting bracket.**

(4) Ensure front wheels of vehicle are positioned straight-ahead, and steering wheel master serration in steering column shaft is positioned at 12 O'clock.

(5) Under the instrument panel, reconnect the intermediate shaft to the steering gear shaft. To do so, perform one of the following that applies:

(a) On early production vehicles, reconnect the steering column intermediate shaft to the steering gear shaft (Fig. 23). Install a **new** intermediate shaft coupler pinch bolt through the coupler and into its nut, then tighten the nut and pinch bolt to a torque of 27 N·m (240 in. lbs.).



**Fig. 27 Mounting Studs Correctly Positioned In Plastic Capsules**

- 1 - STEERING COLUMN UPPER MOUNTING BRACKET
- 2 - STEERING COLUMN ASSEMBLY
- 3 - THESE 2 MOUNTING STUDS MUST BE IN THE CENTER OF THE MOUNTING CAPSULES AS SHOWN BEFORE TIGHTENING AND TORQUING THE UPPER MOUNT NUTS.

(b) On later production vehicles, align the flats and slide the intermediate shaft onto the steering gear shaft aligning the pinch bolt hole with the notch formed into the steering gear shaft. Install a **new** pinch bolt in the intermediate shaft coupler (Fig. 24), then tighten the pinch bolt to a torque of 34 N·m (300 in. lbs.).

(6) On early production vehicles, install a **new** "E" clip on the end of the pinch bolt (Fig. 23).

(7) If equipped with the optional Sentry Key Immobilizer System, install the SKIM module (Fig. 22) on the steering column.

(8) Install wiring harness connector on SKIM module.

(9) Install the shifter/ignition interlock cable (Fig. 21) in the lock cylinder housing.

(10) Route wiring harness on steering column and install routing clip in bottom of steering column jacket.

(11) Install multi and 2 wire wiring harness connectors on the back of the ignition switch (Fig. 19). Then install the 2 wiring harness connectors on the multi function switch (Fig. 19) and (Fig. 20).

(12) Install clockspring on switch housing. Install the 2 wiring harness connectors on the clockspring (Fig. 18).

(13) Install the trim ring for the key cylinder on the lock cylinder housing.

(14) Install the upper and lower steering column shrouds onto the lock housing of the steering column assembly. Install and securely tighten the 2 upper to lower steering column shroud to lock housing attaching screws (Fig. 17).



**REMOVAL AND INSTALLATION (Continued)**

**CAUTION:** Clockspring centering procedure **MUST** be performed prior to installing steering wheel assembly. If clockspring is not centered it may be overextended, causing clockspring assembly to become inoperative. The yellow centering indicator must be present in the centering window of the clockspring and the arrow on the clockspring rotor must be pointing at the centering window.

(15) Center the clock spring using the following procedure.

- Depress the 2 plastic locking pins to disengage clockspring locking mechanism.
- Keeping locking mechanism disengaged, rotate the clockspring rotor in the **CLOCKWISE DIRECTION** to the end of the travel. Do not apply excessive torque.
- From the end of clockwise travel, slowly rotate the rotor in the counterclockwise direction until yellow appears in the centering window of clockspring. When yellow appears in the centering window the arrow on the clockspring rotor will be pointing at yellow window on clock spring.
- Engage the clockspring locking mechanism.

**CAUTION:** Do not install steering wheel onto shaft of steering column assembly by driving it onto the shaft. Pull steering wheel down onto steering column shaft using **ONLY** the steering wheel retaining nut.

(16) Feed clockspring wiring leads through hole in steering wheel (Fig. 15). Position steering wheel on shaft of steering column assembly, making sure to fit flats on hub of steering wheel with formations on inside of clockspring.

(17) Install steering wheel to steering column shaft retaining nut and tighten until steering wheel is fully installed on shaft. Tighten steering wheel retaining nut to a torque of 61 N·m (45 ft. lbs.).

(18) Turn the key cylinder to the unlock position, unlocking the steering column shaft.

(19) Correctly route the speed control switch wiring leads from the clockspring to the speed control switch openings in steering wheel.

(20) Connect the horn switch wiring lead from the clockspring to the airbag module horn switch wiring lead (Fig. 14).

(21) Install the airbag electrical lead into connector on back of airbag module (Fig. 13). Insert locking tab into back of airbag connector (Fig. 12). **Be sure electrical connector from clockspring is securely latched into airbag module connector.**

**CAUTION:** The fasteners, screws, and bolts, originally used for the airbag components are specifically designed for the airbag system. They must never be replaced with any substitutes. Anytime a new fastener is needed, replace only with correct fasteners provided in service packages or fasteners listed in the parts book.

(22) Install airbag module into center of steering wheel. Install **only the 2 original or correct replacement** airbag module attaching bolts (Fig. 11). Torque the 2 airbag module attaching bolts to 10 N·m (90 in. lbs.).

(23) Connect the clockspring electrical leads to the speed control switches. Install the speed control switches in the steering wheel. Install and securely tighten screws attaching the speed control switches to the steering wheel (Fig. 10).

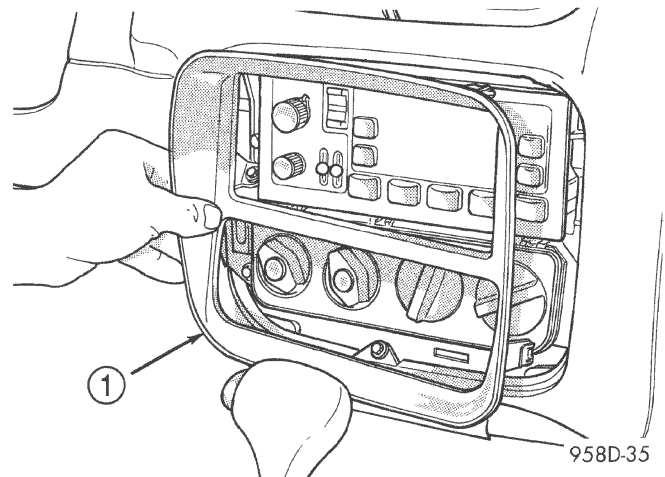
(24) Install lower instrument panel knee bolster onto the lower instrument panel. Install and securely tighten the knee bolster to instrument panel attaching screws (Fig. 9).

(25) Install the instrument panel top cover.

(26) Install screw behind fuse panel cover holding dash panel top cover (Fig. 6). Install fuse panel cover on left end of dash panel.

(27) Install the 3 screws holding dash panel top cover to the center dash panel (Fig. 8).

(28) Install center bezel surrounding radio and climate control (Fig. 28).



**Fig. 28 Installing Center Bezel**

1 - CENTER BEZEL

**CAUTION:** When reconnecting battery on a vehicle that has had the airbag module removed, ensure no occupants are in the vehicle and the following procedure is used.

## REMOVAL AND INSTALLATION (Continued)

(29) Reconnecting of the battery negative cable is to be done using the steps in the procedure listed below.

- Remove forward console or cover as necessary.
- Connect DRB scan tool to diagnostic connector, located at right side of the ASDM module.
- Turn ignition key to ON position. Exit vehicle with the DRB scan tool.
- Ensuring that there are no occupants in the vehicle, connect negative cable to negative post of the battery.

• Using the DRB scan tool, read and record active fault codes. Also read and record any stored fault codes. Refer to the proper Body Diagnostic Test Manual if any faults are found.

• Erase stored faults if there are no active fault codes. If problems remain, fault codes will not erase.

• From the passenger side of the vehicle, turn ignition key to OFF and then ON observing instrument cluster airbag lamp. It should go on for six to eight seconds, then go out. This will indicate that the airbag system is functioning normally.

(30) **If airbag warning lamp fails to light, blinks on and off or goes on and stays on, there is an airbag system malfunction.** Refer to the Body Diagnostic Test Manual to diagnose any system malfunction.

(31) Test the operation of the horn, lights and any other functions that are steering column operated. If applicable reset the radio and the clock.

(32) Road test vehicle to ensure proper operation of the steering system and the speed control system.

## STEERING COLUMN INTERMEDIATE SHAFT

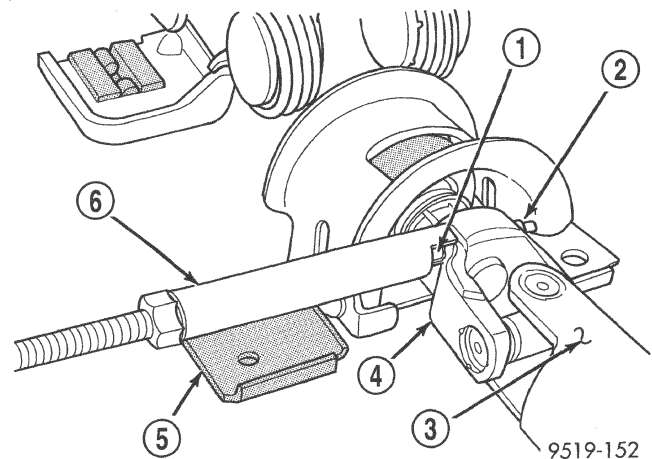
The steering column assembly will need to be removed from the interior of the vehicle to allow for replacement of the steering column shaft coupler assembly.

### REMOVAL

(1) Remove steering column assembly from vehicle. Refer to STEERING COLUMN in this section for the required removal procedure.

(2) Install Remover/Installer, Special Tool 6831-A, through center of roll pin in intermediate shaft's flex joint and install knurled nut (Fig. 29).

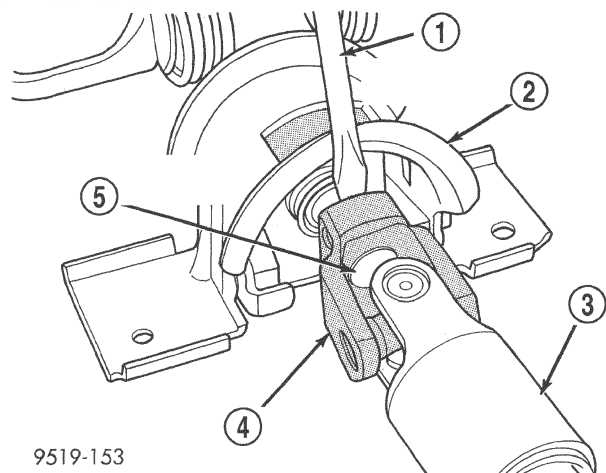
(3) While holding hex on end threaded rod, tighten the nut on threaded rod of Remover/Installer. This will pull the roll pin out of the intermediate shaft's flex joint.



**Fig. 29 Removing Roll Pin From Flex Joint**

- 1 - ROLL PIN
- 2 - KNURLED NUT
- 3 - INTERMEDIATE SHAFT
- 4 - FLEX JOINT
- 5 - STEERING COLUMN LOWER MOUNTING BRACKET
- 6 - SPECIAL TOOL 6831-A

(4) Using a screwdriver inserted between the shaft's flex joint and the steering column lower mounting bracket (Fig. 30), pry intermediate shaft off steering column shaft.



**Fig. 30 Removing Intermediate Shaft**

- 1 - SCREWDRIVER
- 2 - STEERING COLUMN LOWER MOUNTING BRACKET
- 3 - INTERMEDIATE SHAFT
- 4 - FLEX JOINT
- 5 - STEERING COLUMN SHAFT

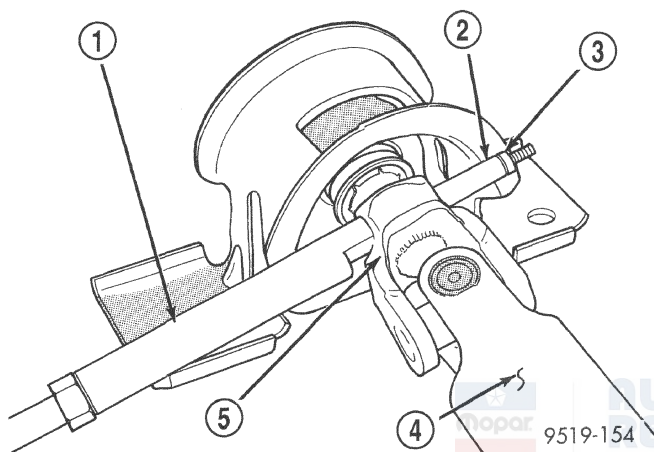


**REMOVAL AND INSTALLATION (Continued)****INSTALLATION**

(1) Start roll pin into flex joint prior to installing intermediate shaft on steering column shaft. Install roll pin into just far enough to square roll pin to hole in flex joint. If roll pin is installed too far, flex joint will not slid onto steering column shaft.

(2) Install intermediate shaft on steering shaft until correctly positioned to allow roll pin to be installed in coupler.

(3) Install Remover/Installer, Special Tool 6831-A, through center of roll pin and install knurled nut as shown (Fig. 31).



**Fig. 31 Tool Set-Up For Installing Roll Pin**

- 1 - SPECIAL TOOL 6831-A
- 2 - ROLL PIN
- 3 - KNURLED NUT
- 4 - INTERMEDIATE SHAFT
- 5 - FLEX JOINT

(4) Using Remover/Installer (Fig. 31), install roll pin into the coupler until roll pin is fully and evenly installed through both sides of the coupler assembly.

(5) Reinstall steering column as necessary back in vehicle. Refer to STEERING COLUMN in this section for the required procedure.

**SPECIFICATIONS****STEERING COLUMN FASTENER TORQUE SPECIFICATIONS****DESCRIPTION****TORQUE****Steering Wheel:**

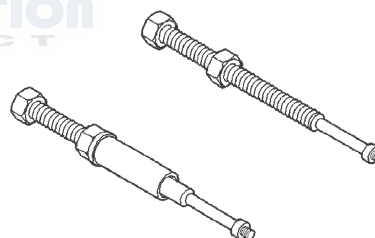
Retaining Nut . . . . . 61 N·m (45 ft. lbs.)

**Steering Column Assembly:**

Mounting Bracket Attaching Nuts . . . . . 17 N·m  
(150 in. lbs.)

**Airbag Module Attaching**

Nuts . . . . . 10 N·m (90 in. lbs.)

**SPECIAL TOOLS****STEERING COLUMN**

**Remover / Installer Steering Shaft Roll Pin 6831A**

# TRANSAXLE

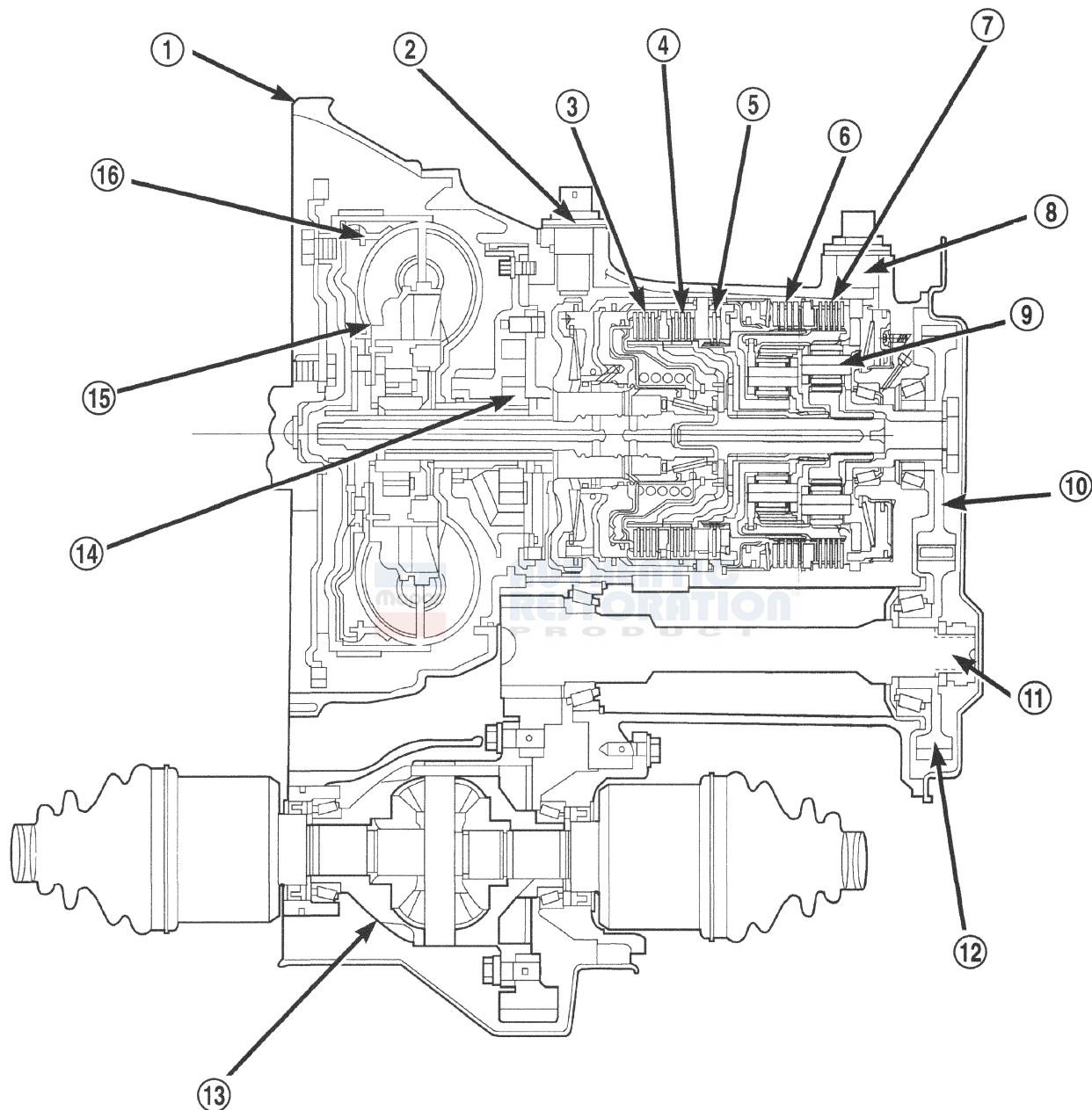
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## DESCRIPTION AND OPERATION

### 41TE TRANSAXLE

#### DESCRIPTION



**Fig. 1 41TE Transaxle**

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- 1 - CASE
- 2 - INPUT SPEED SENSOR
- 3 - UNDERDRIVE CLUTCH
- 4 - OVERDRIVE CLUTCH
- 5 - REVERSE CLUTCH
- 6 - 2/4 CLUTCH
- 7 - LOW/REVERSE CLUTCH
- 8 - OUTPUT SPEED SENSOR

- 9 - PLANETARY GEAR SET
- 10 - OUTPUT SHAFT GEAR
- 11 - TRANSFER SHAFT
- 12 - TRANSFER SHAFT GEAR
- 13 - DIFFERENTIAL
- 14 - OIL PUMP
- 15 - TORQUE CONVERTER
- 16 - TORQUE CONVERTER CLUTCH

## DESCRIPTION AND OPERATION (Continued)

The 41TE (Fig. 1) is a four-speed transaxle that is a conventional hydraulic/mechanical assembly with an integral differential, and is controlled with adaptive electronic controls and monitors. The hydraulic system of the transaxle consists of the transaxle fluid, fluid passages, hydraulic valves, and various line pressure control components. An input clutch assembly which houses the underdrive, overdrive, and reverse clutches is used. It also utilizes separate holding clutches: 2nd/4th gear and Low/Reverse. The primary mechanical components of the transaxle consist of the following:

- Three multiple disc input clutches
- Two multiple disc holding clutches
- Four hydraulic accumulators
- Two planetary gear sets
- Hydraulic oil pump
- Valve body
- Solenoid/Pressure switch assembly
- Integral differential assembly

Control of the transaxle is accomplished by fully adaptive electronics. Optimum shift scheduling is accomplished through continuous real-time sensor feedback information provided to the Transmission Control Module (TCM).

The TCM is the heart of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC's, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the DRB scan tool.

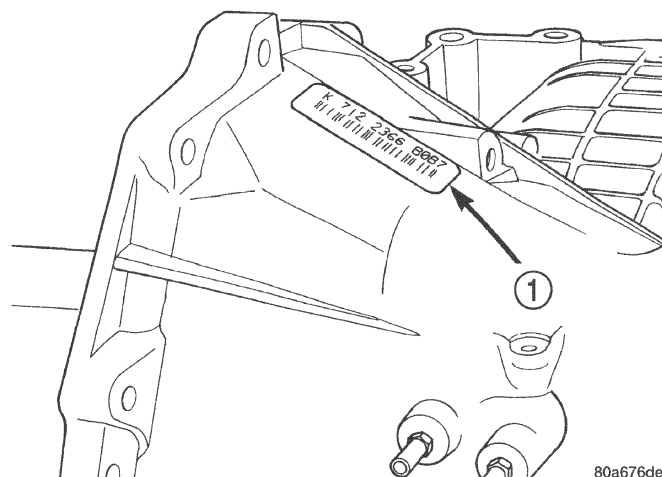
### TRANSAXLE IDENTIFICATION

The 41TE transaxle identification code is a series of digits printed on a bar-code label that is fixed to the transaxle case as shown in (Fig. 2).

For example, the identification code K 821 1125 1316 can be broken down as follows:

- K = Kokomo Transmission Plant
- 821 = Last three digits of the transaxle part number
- 1125 = Build date
- 1316 = Build sequence number

If the tag is not legible or missing, the "PK" number, which is stamped into the transaxle case behind the transfer gear cover, can be referred to for identification. This number differs slightly in that it contains the entire transaxle part number, rather than the last three digits.



**Fig. 2 Transaxle Identification Label**

1 – IDENTIFICATION TAG

### OPERATION

Transmission output is directed to an integral differential by a transfer gear system in the following input-to-output ratios:

First .....	2.84 : 1
Second .....	1.57 : 1
Third .....	1.00 : 1
Overdrive .....	0.69 : 1
Reverse .....	2.21 : 1

Final Drive Ratio (FDR) for all 2.5L equipped JX models is 3.91

### FLUID REQUIREMENT

**NOTE:** Refer to the maintenance schedules in Group 0, Lubrication and Maintenance for the recommended maintenance (fluid/filter change) intervals for this transaxle.

**NOTE:** Refer to Service Procedures in this group for fluid level checking procedures.

**NOTE:** The transmission and differential sump have a common oil sump with an opening between the two.

### DESCRIPTION

Mopar® ATF+4 (Automatic Transmission Fluid-Type 9602) is required in this transaxle. Substitute fluids can induce torque converter clutch shudder.

Mopar® ATF+4 (Automatic Transmission Fluid-Type 9602) when new is red in color. The ATF is dyed red so it can be identified from other fluids used in



## DESCRIPTION AND OPERATION (Continued)

the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.** A dark brown/black fluid accompanied with a burnt odor and/or deterioration in shift quality may indicate fluid deterioration or transmission component failure.

### FLUID ADDITIVES

DaimlerChrysler strongly recommends against the addition of any fluids to the transmission, other than those automatic transmission fluids listed above. Exceptions to this policy are the use of special dyes to aid in detecting fluid leaks.

Various “special” additives and supplements exist that claim to improve shift feel and/or quality. These additives and others also claim to improve converter clutch operation and inhibit overheating, oxidation, varnish, and sludge. These claims have not been supported to the satisfaction of DaimlerChrysler and these additives **must not be used.** The use of transmission “sealers” should also be avoided, since they may adversely affect the integrity of transmission seals.

## TORQUE CONVERTER

### DESCRIPTION

The torque converter is located in the bellhousing area of the transaxle, between the engine and transaxle. The torque converter is a fluid coupling that transmits torque from the engine drive plate to the input shaft of the transaxle. The torque converter consists of four main components (Fig. 3) :

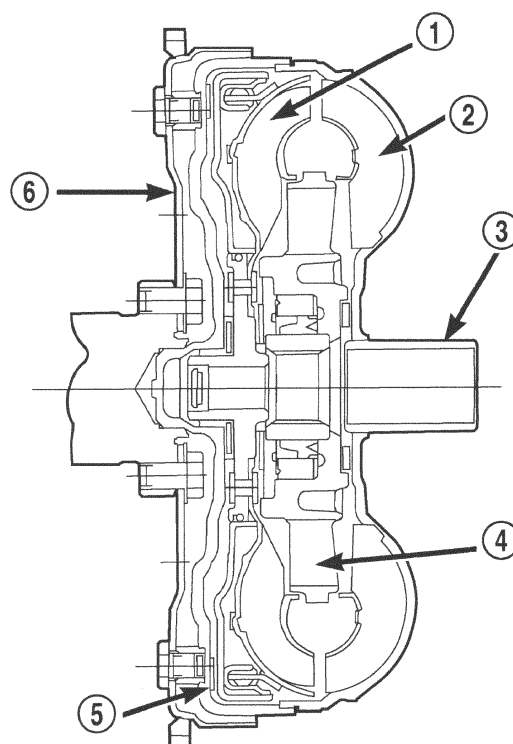
- Impeller
- Turbine
- Stator
- Converter Clutch assembly

### OPERATION

The converter impeller (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

Torque is transmitted by fluid passing through curved vanes in both the impeller and turbine. Since the coupling is produced by transmission fluid, the turbine can slip or turn slower than the impeller.

The stator contains a one-way overrunning clutch, which free-wheels when the impeller and turbine are rotating at the same speed. However, the stator stops when speed reduction or torque increase take place. When the stator stops, it changes the direction of the fluid leaving the turbine vanes. This directs fluid



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**Fig. 3 Torque Converter Assembly**

- 1 - TURBINE
- 2 - IMPELLER
- 3 - HUB
- 4 - STATOR
- 5 - CONVERTER CLUTCH DISC
- 6 - DRIVE PLATE

back into the impeller with greater force, resulting in torque multiplication.

The torque converter clutch is hydraulically operated and controlled by the TCM. It consists of a piston and a frictional disc that form a direct mechanical link between the impeller and turbine when slippage is inefficient or unnecessary.

The torque converter hub drives the transmission oil pump.

## ELECTRONICALLY MODULATED CONVERTER CLUTCH

In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the LR/CC solenoid to achieve a smooth application of the torque converter clutch. This function, also referred as “Electronically Modulated Converter Clutch (EMCC)”, can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature

## DESCRIPTION AND OPERATION (Continued)

- Input speed
- Throttle angle
- Engine speed

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with fine control over the LR/CC solenoid. There are four output logic states that can be applied as follows:

- No EMCC
- Partial EMCC
- Full EMCC
- Gradual-to-no EMCC

### NO EMCC

Under No EMCC conditions, the L/R Solenoid is OFF. There are several conditions that can result in NO EMCC operations. No EMCC can be initiated due to a fault in the transaxle or because the TCM does not see the need for EMCC under current driving conditions.

### PARTIAL EMCC

Partial EMCC operation modulates the L/R Solenoid (duty cycle) to obtain partial torque converter clutch application. Partial EMCC operation is maintained until Full EMCC is called for an actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low speeds, low load and light throttle situations.

### FULL EMCC

During Full EMCC operation, the TCM increases the L/R Solenoid duty cycle to full ON after Partial EMCC control brings the engine speed within the desired slip range of transaxle input speed relative to engine rpm.

### GRADUAL-TO-NO EMCC

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the L/R Solenoid duty cycle.

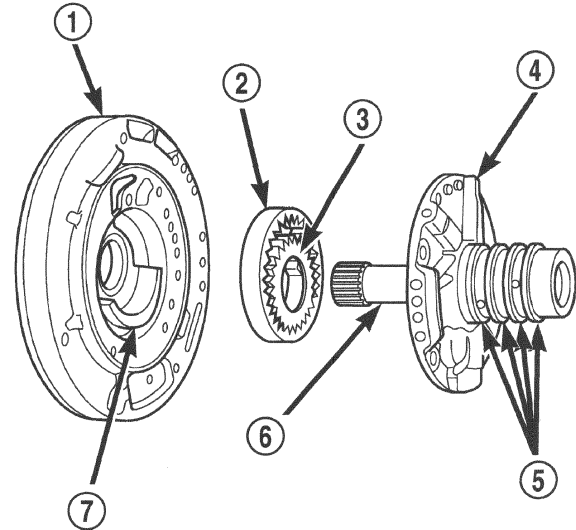
## OIL PUMP

### DESCRIPTION

The oil pump is located in the pump housing inside the bell housing of the transaxle case. The oil pump consists of an inner and outer gear, a housing, and a cover that also serves as the reaction shaft support.

### OPERATION

As the torque converter rotates, the converter hub rotates the inner and outer gears. As the gears rotate, the clearance between the gear teeth increases in the crescent area, and creates a suction at the inlet side of the pump. This suction draws fluid through the



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**Fig. 4 Oil Pump Assembly**

- 1 - PUMP HOUSING
- 2 - OUTER PUMP GEAR
- 3 - INNER PUMP GEAR
- 4 - REACTION SHAFT SUPPORT
- 5 - SEAL RINGS (4)
- 6 - REACTION SHAFT
- 7 - CRESCENT

pump inlet from the oil pan. As the clearance between the gear teeth in the crescent area decreases, it forces pressurized fluid into the pump outlet and to the valve body.

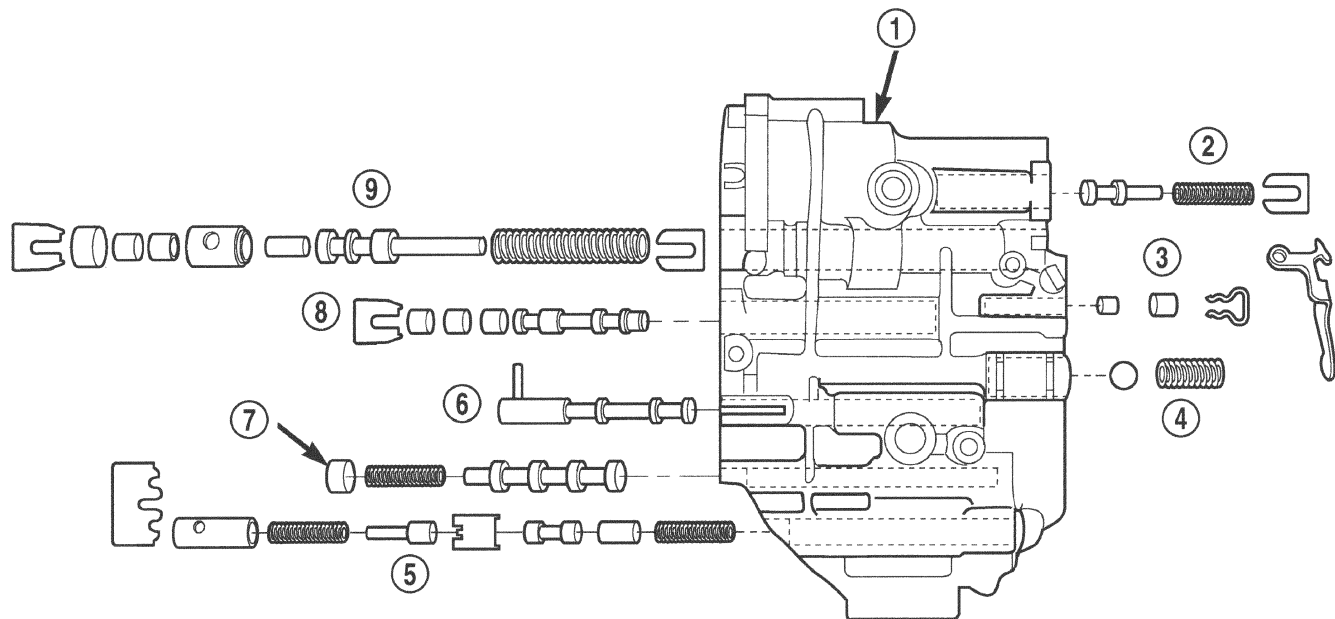
## VALVE BODY

### DESCRIPTION

The valve body assembly consists of a cast aluminum valve body, a separator plate, and transfer plate. The valve body contains valves and check balls that control fluid delivery to the torque converter clutch, solenoid/pressure switch assembly, and frictional clutches. The valve body contains the following components (Fig. 5) :

- Regulator valve
- Solenoid switch valve
- Manual valve
- Converter clutch switch valve
- Converter clutch control valve
- Torque converter regulator valve
- Low/Reverse switch valve
- Vent reservoir check valve

In addition, the valve body also contains the thermal valve, #2,3&4 check balls, the #5 (overdrive) check valve and the 2/4 accumulator assembly. Refer to Valve Body Disassembly & Assembly for the location of these components.

**DESCRIPTION AND OPERATION (Continued)****Fig. 5 Valve Body Assembly**

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- |                                    |                                   |
|------------------------------------|-----------------------------------|
| 1 - VALVE BODY                     | 6 - MANUAL VALVE                  |
| 2 - T/C REGULATOR VALVE            | 7 - CONVERTER CLUTCH SWITCH VALVE |
| 3 - L/R SWITCH VALVE               | 8 - SOLENOID SWITCH VALVE         |
| 4 - VENT RESERVOIR CHECK VALVE     | 9 - REGULATOR VALVE               |
| 5 - CONVERTER CLUTCH CONTROL VALVE |                                   |

**OPERATION**

**NOTE:** Refer to the Hydraulic Schematics for a visual aid in determining valve location, operation and design.

**REGULATOR VALVE**

The regulator valve controls hydraulic pressure in the transaxle. It receives unregulated pressure from the pump, which works against spring tension to maintain oil at specific pressures. A system of sleeves and ports allows the regulator valve to work at one of three predetermined pressure levels. Regulated oil pressure is also referred to as "line pressure."

**SOLENOID SWITCH VALVE**

The solenoid switch valve controls line pressure from the LR/CC solenoid. In one position, it allows the low/reverse clutch to be pressurized. In the other, it directs line pressure to the converter control and converter clutch valves.

**MANUAL VALVE**

The manual valve is operated by the mechanical shift linkage. Its primary responsibility is to send

line pressure to the appropriate hydraulic circuits and solenoids. The valve has three operating ranges or positions.

**CONVERTER CLUTCH SWITCH VALVE**

The main responsibility of the converter clutch switch valve is to control hydraulic pressure applied to the front (off) side of the converter clutch piston. Line pressure from the regulator valve is fed to the torque converter regulator valve, where it passes through the valve, and is slightly regulated. The pressure is then directed to the converter clutch switch valve and to the front side of the converter clutch piston. This pressure pushes the piston back and disengages the converter clutch.

**CONVERTER CLUTCH CONTROL VALVE**

The converter clutch control valve controls the back (on) side of the torque converter clutch. When the TCM energizes or modulates the LR/CC solenoid to apply the converter clutch piston, both the converter clutch control valve and the converter control valve move, allowing pressure to be applied to the back side of the clutch.



## DESCRIPTION AND OPERATION (Continued)

### T/C REGULATOR VALVE

The torque converter regulator valve slightly regulates the flow of fluid to the torque converter.

### LOW/REVERSE SWITCH VALVE

The low/reverse clutch is applied from different sources, depending on whether low (1st) gear or reverse is selected. The low/reverse switch valve alternates positions depending on from which direction fluid pressure is applied. By design, when the valve is shifted by fluid pressure from one channel, the opposing channel is blocked. The switch valve alienates the possibility of a sticking ball check, thus providing consistent application of the low/reverse clutch under all operating conditions.

### VENT RESERVOIR CHECK VALVE

The vent reservoir check valve is designed for quick venting during garage shifts to prevent the overdrive and reverse clutches from dragging. Inadvertent motion of the reverse/overdrive (push/pull) piston can be caused by the unbalanced centrifugal forces in the reverse and overdrive chambers. By linking the overdrive and reverse vents to the vent reservoir at the manual valve, an equal residual pressure will be maintained, thus balancing the centrifugal forces in the reverse and the overdrive chambers.

## ACCUMULATORS

### DESCRIPTION

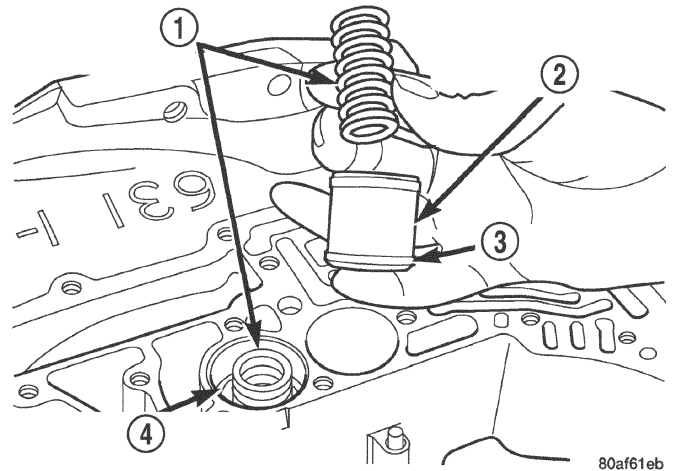
The 41te underdrive, overdrive, low/reverse, and 2/4 clutch hydraulic circuits each contain an accumulator. An accumulator typically consists of a piston, seals, return spring(s), and a cover or plug. The overdrive and underdrive accumulators are located within the transaxle case, and are retained by the valve body (Fig. 6).

The low reverse accumulator (Fig. 7) is also located within the transaxle case, but the assembly is retained by a cover and a snap-ring.

The 2/4 accumulator is located in the valve body. It is retained by a cover and retaining screws (Fig. 8).

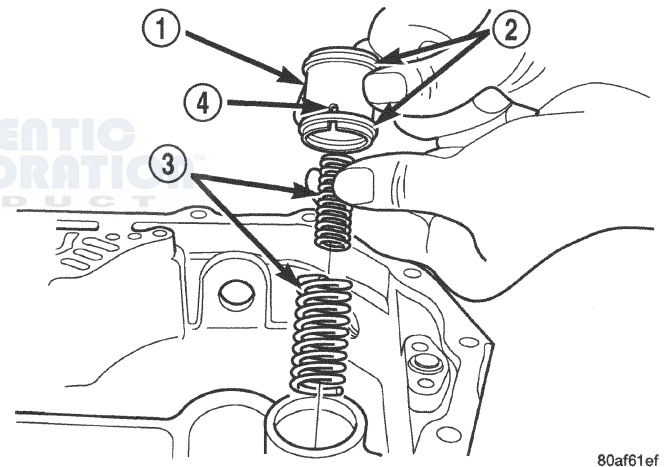
### OPERATION

The function of an accumulator is to cushion the application of a frictional clutch element. When pressurized fluid is applied to a clutch circuit, the application force is dampened by fluid collecting in the respective accumulator chamber against the piston and spring(s). The intended result is a smooth, firm clutch application.



**Fig. 6 Underdrive and Overdrive Accumulators**

- 1 - RETURN SPRING
- 2 - UNDERDRIVE CLUTCH ACCUMULATOR
- 3 - SEAL RING (2)
- 4 - OVERDRIVE CLUTCH ACCUMULATOR



**Fig. 7 Low/Reverse Accumulator Assembly**

- 1 - ACCUMULATOR PISTON
- 2 - SEAL RINGS
- 3 - RETURN SPRINGS
- 4 - (NOTE NOTCH)

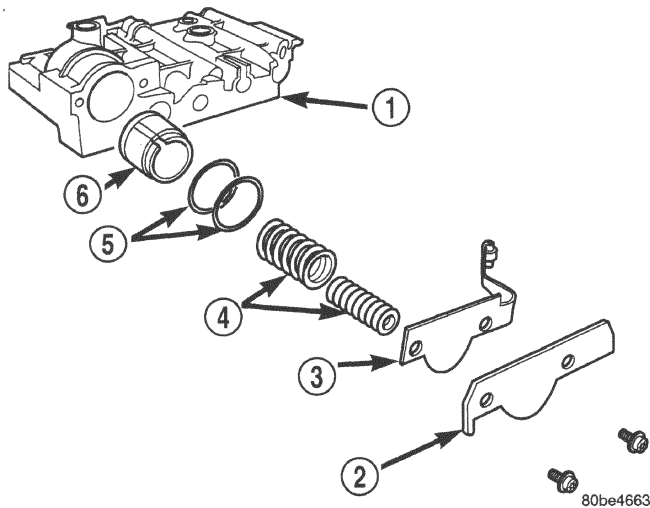
## INPUT CLUTCHES

### DESCRIPTION

Three hydraulically applied input clutches are used to drive planetary components. The underdrive, overdrive, and reverse clutches are considered input clutches and are contained within the input clutch assembly (Fig. 9). The input clutch assembly also contains:

- Input shaft
- Input hub
- Clutch retainer
- Underdrive piston



**DESCRIPTION AND OPERATION (Continued)****Fig. 8 2/4 Accumulator Assembly**

- 1 - VALVE BODY
- 2 - RETAINER PLATE
- 3 - DETENT SPRING
- 4 - SPRINGS
- 5 - SEALS
- 6 - PISTON

- Overdrive/reverse piston
- Overdrive hub
- Underdrive hub

**OPERATION**

The three input clutches are responsible for driving different components of the planetary geartrain.

**NOTE:** Refer to the "Elements In Use" chart in **Diagnosis and Testing** for a collective view of which clutch elements are applied at each position of the selector lever.

**UNDERDRIVE CLUTCH**

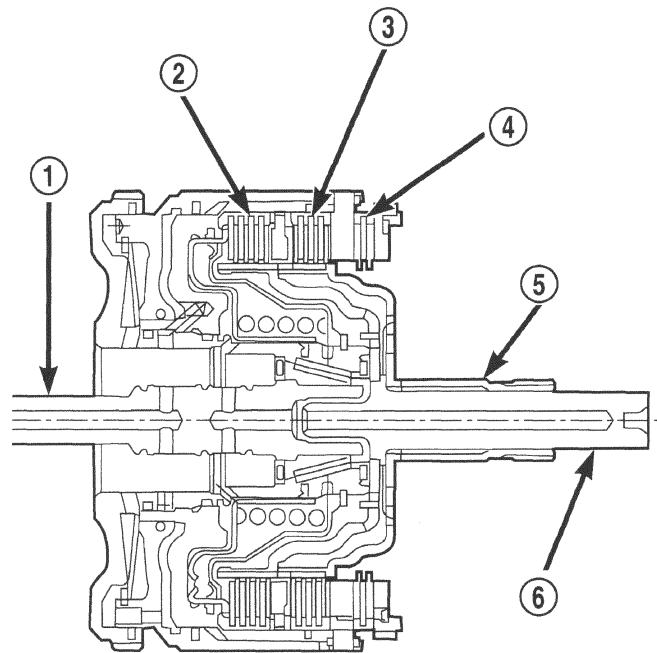
The underdrive clutch is hydraulically applied in first, second, and third (direct) gears by pressurized fluid against the underdrive piston. When the underdrive clutch is applied, the underdrive hub drives the rear sun gear.

**OVERDRIVE CLUTCH**

The overdrive clutch is hydraulically applied in third (direct) and overdrive gears by pressurized fluid against the overdrive/reverse piston. When the overdrive clutch is applied, the overdrive hub drives the front planet carrier.

**REVERSE CLUTCH**

The reverse clutch is hydraulically applied in reverse gear only by pressurized fluid against the overdrive/reverse piston. When the reverse clutch is applied, the front sun gear assembly is driven.



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**Fig. 9 Input Clutch Assembly**

- 1 - INPUT SHAFT
- 2 - UNDERDRIVE CLUTCH
- 3 - OVERDRIVE CLUTCH
- 4 - REVERSE CLUTCH
- 5 - OVERDRIVE SHAFT
- 6 - UNDERDRIVE SHAFT

**HOLDING CLUTCHES****DESCRIPTION**

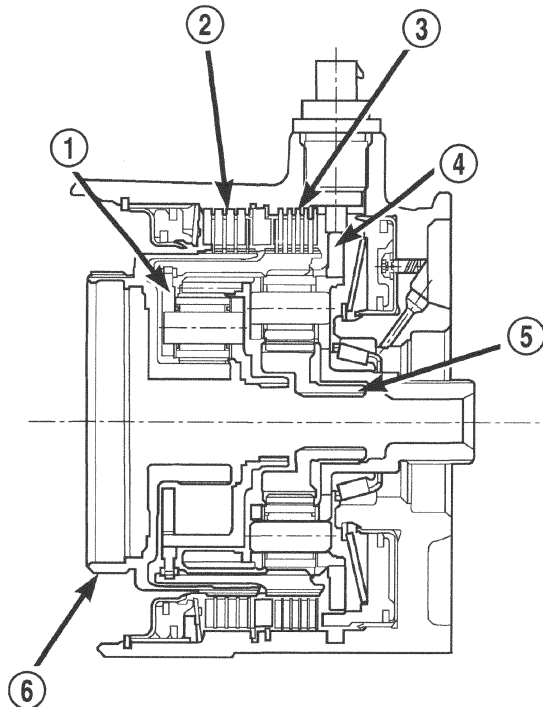
Two hydraulically applied multi-disc clutches are used to hold planetary geartrain components stationary while the input clutches drive others. The 2/4 and Low/Reverse clutches are considered holding clutches and are contained at the rear of the transaxle case. (Fig. 10).

**OPERATION**

**NOTE:** Refer to the "Elements In Use" chart in **Diagnosis and Testing** for a collective view of which clutch elements are applied at each position of the selector lever.

**2/4 CLUTCH**

The 2/4 clutch is hydraulically applied in second and fourth gears by pressurized fluid against the 2/4 clutch piston. When the 2/4 clutch is applied, the front sun gear assembly is held or grounded to the transaxle case.

**DESCRIPTION AND OPERATION (Continued)**

80be46c5

**Fig. 10 2/4 and Low/Reverse Clutches**

- 1 - FRONT PLANET CARRIER/REAR ANNULUS
- 2 - 2/4 CLUTCH
- 3 - L/R CLUTCH
- 4 - REAR PLANET CARRIER/FRONT ANNULUS
- 5 - REAR SUN GEAR
- 6 - FRONT SUN GEAR ASSEMBLY

**LOW/REVERSE CLUTCH**

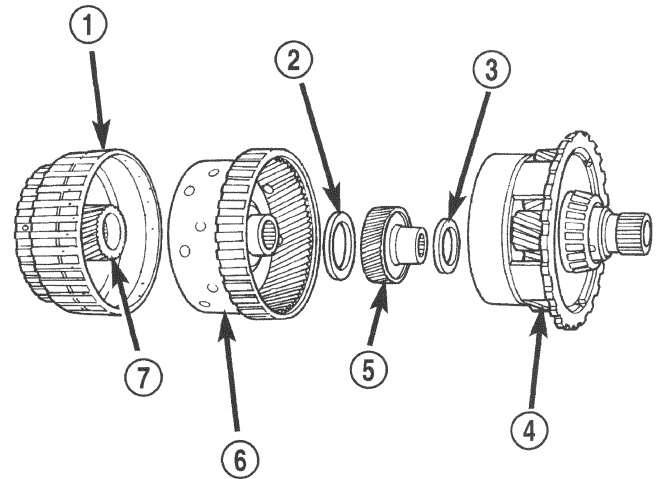
The Low/Reverse clutch is hydraulically applied in park, reverse, neutral, and first gears by pressurized fluid against the Low/Reverse clutch piston. When the Low/Reverse clutch is applied, the front planet carrier/rear annulus assembly is held or grounded to the transaxle case.

**PLANETARY GEARTRAIN****DESCRIPTION**

The planetary geartrain is located between the input clutch assembly and the rear of the transaxle case. The planetary geartrain consists of two sun gears, two planetary carriers, two annulus (ring) gears, and one output shaft (Fig. 11).

**OPERATION**

The planetary geartrain utilizes two planetary gear sets that connect the transmission input shaft to the output shaft. Input and holding clutches drive or lock different planetary members to change output ratio or direction.



80be46c9

**Fig. 11 Planetary Geartrain**

- 1 - FRONT SUN GEAR ASSEMBLY
- 2 - #6 THRUST BEARING
- 3 - #7 THRUST BEARING
- 4 - REAR CARRIER FRONT ANNULUS ASSEMBLY
- 5 - REAR SUN GEAR
- 6 - FRONT CARRIER REAR ANNULUS ASSEMBLY
- 7 - FRONT SUN GEAR

**DIFFERENTIAL****DESCRIPTION**

The 41TE differential is a conventional open design. It consists of a ring gear and a differential case. The differential case consists of pinion and side gears, and a pinion shaft. The differential case is supported in the transaxle by tapered roller bearings (Fig. 12).

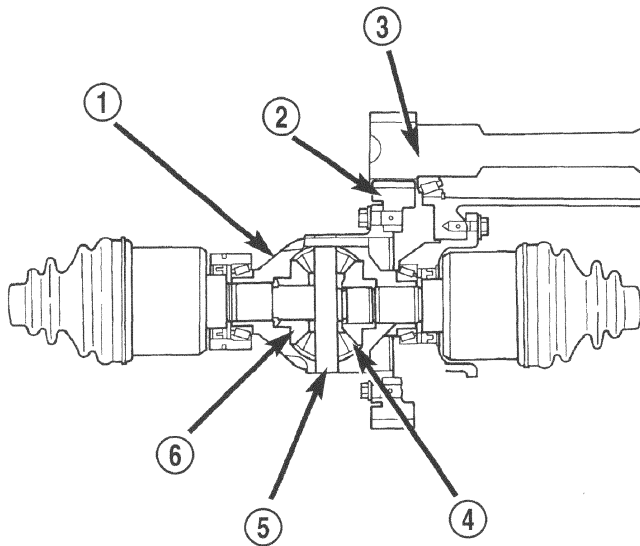
**OPERATION**

The differential assembly is driven by the transfer shaft by way of the differential ring gear. The ring gear drives the differential case, and the case drives the driveshafts through the differential gears. The differential pinion and side gears are supported in the case by thrust washers and a pinion shaft. Differential pinion and side gears make it possible for front tires to rotate at different speeds while cornering.

**TRANSMISSION CONTROL MODULE****DESCRIPTION**

The Transmission Control Module (TCM) is located in the engine compartment on the left (driver's) side next to the Power Distribution Center (PDC) (Fig. 13).

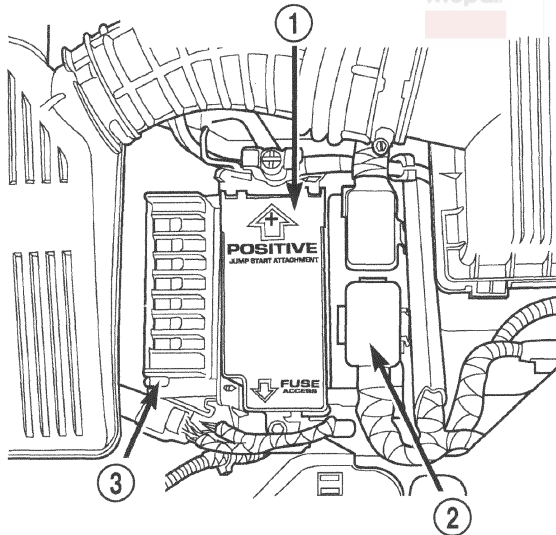
## DESCRIPTION AND OPERATION (Continued)



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Fig. 12 Differential Assembly

- 1 - DIFFERENTIAL CASE
- 2 - RING GEAR
- 3 - TRANSFER SHAFT
- 4 - PINION GEAR
- 5 - PINION SHAFT
- 6 - SIDE GEAR



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Fig. 13 Transmission Control Module Location (Typical)

- 1 - POWER DISTRIBUTION CENTER (PDC)
- 2 - POWERTRAIN CONTROL MODULE (PCM)
- 3 - TRANSMISSION CONTROL MODULE (TCM)

## OPERATION

The TCM is the controlling unit for all electronic operations of the transaxle. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and selects the operational mode

of the transaxle. Direct inputs are hardwired to, and used specifically by the TCM. Indirect inputs originate from other components/modules, and are shared with the TCM via the communication bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition "ON" voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor
- Crankshaft Position Sensor (CKP)
- Transmission Range Sensor (TRS)
- Pressure Switches (L/R, 2/4, OD)
- Transmission Temperature Sensor (Integral to TRS)
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor
- TRS Hall Effect Switch (Autostick)

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Speed Control ON/OFF Switch
- Engine Coolant Temperature
- Ambient/Battery Temperature
- Brake Switch Status
- DRB Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

Some examples of TCM **direct outputs** are:

- Transmission Control Relay
- Solenoids (LR/CC, 2/4, OD and UD)
- Vehicle Speed (to PCM)
- Torque Reduction Request (to PCM)

Some examples of TCM **indirect outputs** are:

- Transmission Temperature (to PCM)
- PRNDL Position (to BCM)
- Autostick Display (to BCM)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:

- Storing and maintaining Clutch Volume Indices (CVI)
- Storing and selecting appropriate Shift Schedules
- System self-diagnostics
- Diagnostic capabilities (with DRB scan tool)

**NOTE:** If the TCM has been replaced, the "Quick Learn Procedure" must be performed. Refer to "Quick Learn Procedure" in Service Procedures of this group.



## DESCRIPTION AND OPERATION (Continued)

### CLUTCH VOLUME INDEX (CVI)

An important function of the TCM is to monitor Clutch Volume Index (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

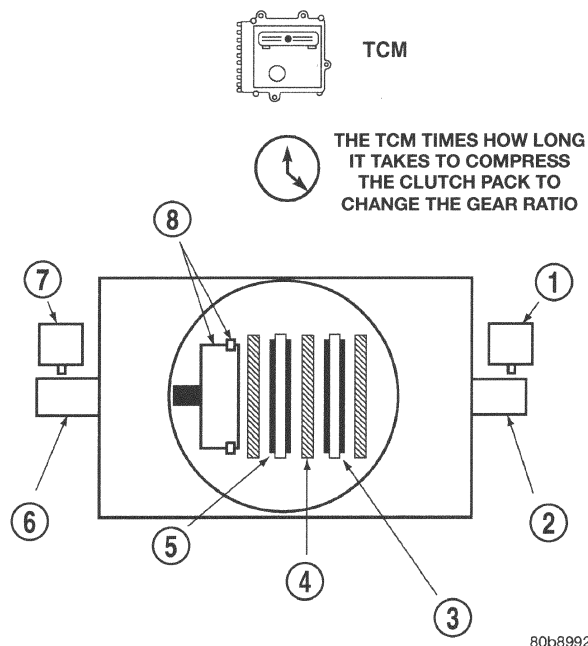
By comparing the two inputs, the TCM can determine transaxle gear ratio. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur (Fig. 14).

Gear ratios can be determined by using the DRB Scan Tool and reading the Input/Output Speed Sensor values in the "Monitors" display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.

For example, if the input shaft is rotating at 1000 rpm and the output shaft is rotating at 500 rpm, then the TCM can determine that the gear ratio is 2:1. In direct drive (3rd gear), the gear ratio changes to 1:1. The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.

The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

Certain mechanical problems within the clutch assemblies (broken return springs, out of position snap rings, excessive clutch pack clearance, improper



**Fig. 14 Example of CVI Calculation**

- 1 – OUTPUT SPEED SENSOR
- 2 – OUTPUT SHAFT
- 3 – CLUTCH PACK
- 4 – SEPARATOR PLATE
- 5 – FRICTION DISCS
- 6 – INPUT SHAFT
- 7 – INPUT SPEED SENSOR
- 8 – PISTON AND SEAL

assembly, etc.) can cause inadequate or out-of-range clutch volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:

CLUTCH VOLUMES				
Clutch	When Updated			Proper Clutch Volume
	Shift Sequence	Oil Temperature	Throttle Angle	
L/R	2-1 or 3-1 coast downshift	> 70°	< 5°	35 to 83
2/4	1-2 shift	> 110°	5 - 54°	20 to 77
OD	2-3 shift			48 to 150
UD	4-3 or 4-2 shift		> 5°	24 to 70



**DESCRIPTION AND OPERATION (Continued)****SHIFT SCHEDULES**

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position

- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following chart to determine the appropriate operation expected, depending on driving conditions.

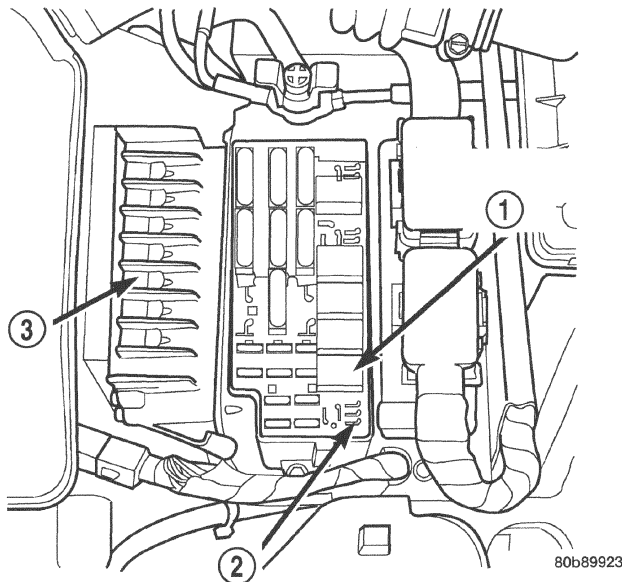
Schedule	Condition	Expected Operation
<b>Extreme Cold</b>	Oil temperature at start-up below -16° F	Park, Reverse, Neutral and 2nd gear only (prevents shifting which may fail a clutch with frequent shifts)
<b>Cold</b>	Oil temperature at start-up above -12° F and below 36° F	<ul style="list-style-type: none"> <li>– Delayed 2-3 upshift (approximately 22-31 mph)</li> <li>– Delayed 3-4 upshift (45-53 mph)</li> <li>– Early 4-3 coastdown shift (approximately 30 mph)</li> <li>– Early 3-2 coastdown shift (approximately 17 mph)</li> <li>– High speed 4-2, 3-2, 2-1 kickdown shifts are prevented</li> <li>– No EMCC</li> </ul>
<b>Warm</b>	Oil temperature at start-up above 36° F and below 80 degree F	<ul style="list-style-type: none"> <li>– Normal operation (upshift, kickdowns, and coastdowns)</li> <li>– No EMCC</li> </ul>
<b>Hot</b>	Oil temperature at start-up above 80° F	<ul style="list-style-type: none"> <li>– Normal operation (upshift, kickdowns, and coastdowns)</li> <li>– Full EMCC, no PEMCC except to engage FEMCC (except at closed throttle at speeds above 70-83 mph)</li> </ul>
<b>Overheat</b>	Oil temperature above 240° F or engine coolant temperature above 244° F	<ul style="list-style-type: none"> <li>– Delayed 2-3 upshift (25-32 mph)</li> <li>– Delayed 3-4 upshift (41-48 mph)</li> <li>– 3rd gear FEMCC from 30-48 mph</li> <li>– 3rd gear PEMCC from 27-31 mph</li> </ul>
<b>Super Overheat</b>	Oil temperature above 260° F	<ul style="list-style-type: none"> <li>– All "Overheat" shift schedule features apply</li> <li>– 2nd gear PEMCC above 22 mph</li> <li>– Above 22 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made</li> </ul>

## DESCRIPTION AND OPERATION (Continued)

### TRANSMISSION CONTROL RELAY

#### DESCRIPTION

The transmission control relay is located in the Power Distribution Center (PDC) on the left side of the engine compartment (Fig. 15).



**Fig. 15 Transmission Control Relay Location (Typical)**

- 1 - TRANSMISSION CONTROL RELAY
- 2 - PDC
- 3 - TCM

#### OPERATION

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode. When the relay is "off", no power is supplied to the solenoid pack and the transmission is in "limp-in" mode. After a controller reset (ignition key turned to the "run" position or after cranking engine), the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

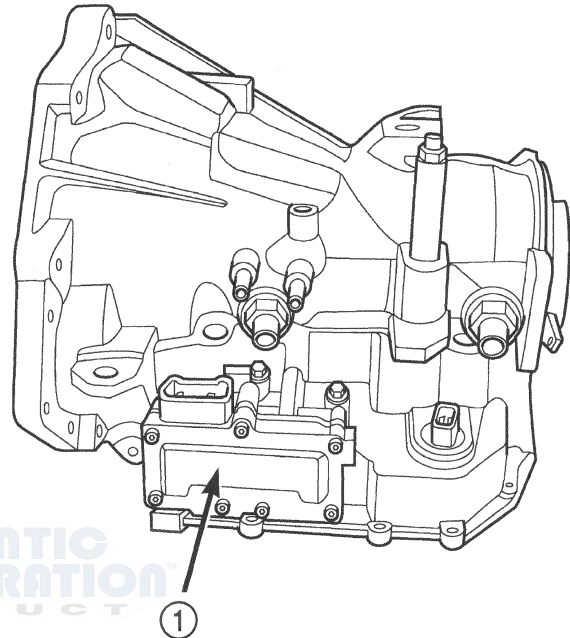
### SOLENOID/PRESSURE SWITCH ASSEMBLY

#### DESCRIPTION

The Solenoid/Pressure Switch Assembly (Fig. 16) is external to the transaxle and mounted to the transaxle case. The assembly consists of four solenoids that control hydraulic pressure to the LR/CC, 2/4, OD, and UD friction elements. The reverse clutch is

controlled by line pressure from the manual valve in the valve body. The solenoids are contained within the Solenoid/Pressure Switch Assembly, and can only be serviced by replacing the assembly.

The solenoid assembly also contains pressure switches that monitor and send hydraulic circuit information to the TCM. Likewise, the pressure switches can only be serviced by replacing the assembly.



**Fig. 16 Solenoid/Pressure Switch Assembly**

- 1 - SOLENOID AND PRESSURE SWITCH ASSEMBLY

#### OPERATION

##### SOLENOIDS

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid needed. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The 2/4 and UD solenoids are normally applied, which by design allow fluid to pass through in their relaxed or "off" state. This allows transaxle limp-in (P,R,N,2) in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

**DESCRIPTION AND OPERATION (Continued)****PRESSURE SWITCHES**

The TCM relies on three pressure switches to monitor fluid pressure in the L/R, 2/4, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The range for the pressure switch closing and opening points is 11-23 psi. Typically the switch opening point will be approximately one psi lower than the closing point. For example, a switch may close at 18 psi and open at 17 psi. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

**PRESSURE SWITCH STATES**

GEAR	L/R	2/4	OD
R	OP	OP	OP
P/N	CL	OP	OP
1st	CL	OP	OP
2nd	OP	CL	OP
D	OP	OP	CL
OD	OP	CL	CL

OP = OPEN

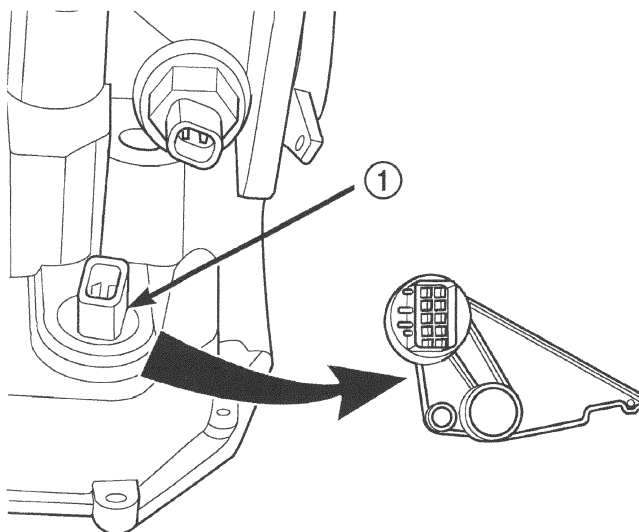
CL = CLOSED

A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

The TCM also tests the 2/4 and OD pressure switches when they are normally off (OD and 2/4 are tested in 1st gear, OD in 2nd gear, and 2/4 in 2nd gear). The test simply verifies that they are operational, by looking for a closed state when the corresponding element is applied. Immediately after a shift into 1st, 2nd, or 3rd gear with the engine speed above 1000 rpm, the TCM momentarily turns on element pressure to the 2/4 and/or OD clutch circuits to identify that the appropriate switch has closed. If it doesn't close, it is tested again. If the switch fails to close the second time, the appropriate Diagnostic Trouble Code (DTC) will set.

**TRANSMISSION RANGE SENSOR****DESCRIPTION**

The Transmission Range Sensor (TRS) is mounted to the top of the valve body inside the transaxle and can only be serviced by removing the valve body. The electrical connector extends through the transaxle case (Fig. 17).



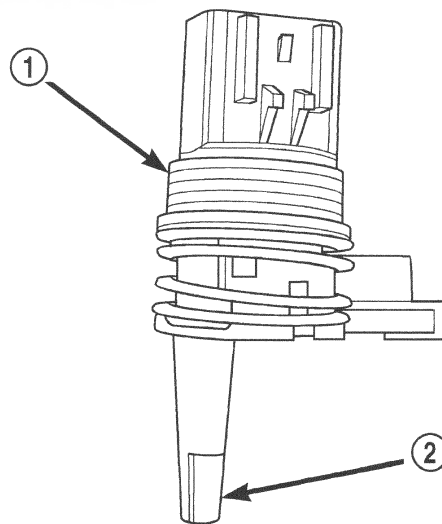
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**Fig. 17 Transmission Range Sensor (TRS) Location**

1 - TRANSMISSION RANGE SENSOR

The Transmission Range Sensor (TRS) has four switch contacts that monitor shift lever position and send the information to the TCM.

The TRS also has an integrated temperature sensor (thermistor) that communicates transaxle temperature to the TCM and PCM (Fig. 18).



80be46cC

**Fig. 18 Transmission Temperature Sensor**

1 - TRANSMISSION RANGE SENSOR

2 - TEMPERATURE SENSOR

**OPERATION**

The Transmission Range Sensor (TRS) (Fig. 17) communicates shift lever position (SLP) to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives



## DESCRIPTION AND OPERATION (Continued)

from four sense circuits. The TCM interprets this information and determines the appropriate transaxle gear position and shift schedule.

Since there are four switches, there are 16 possible combinations of open and closed switches (codes). Seven of these codes are related to gear position and three are recognized as "between gear" codes. This results in six codes which should never occur. These are called "invalid" codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

### TRS SWITCH STATES

SLP	T42	T41	T3	T1
P	CL	CL	CL	OP
R	CL	OP	OP	OP
N	CL	CL	OP	CL
OD	OP	OP	OP	CL
3 (AS)	OP	OP	CL	OP
L	CL	OP	CL	CL

### TRANSMISSION TEMPERATURE SENSOR

The TRS has an integrated thermistor (Fig. 18) that the TCM uses to monitor the transmission's sump temperature. Since fluid temperature can affect transmission shift quality and converter lock up, the TCM requires this information to determine which shift schedule to operate in. The PCM also monitors this temperature data so it can energize the vehicle cooling fan(s) when a transmission "overheat" condition exists. If the thermistor circuit fails, the TCM will revert to calculated oil temperature usage.

### CALCULATED TEMPERATURE

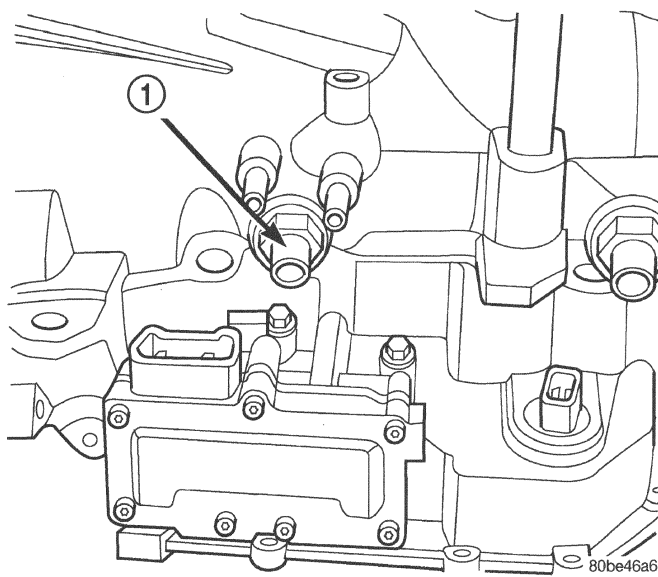
A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

## INPUT SPEED SENSOR

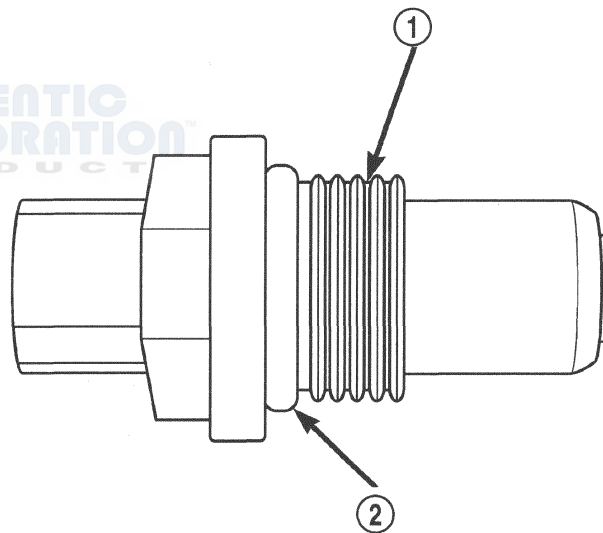
### DESCRIPTION

The Input Speed Sensor is a two-wire magnetic pickup device that generates AC signals as rotation occurs. It is threaded into the transaxle case (Fig. 19), sealed with an o-ring (Fig. 20), and is considered a primary input to the Transmission Control Module (TCM).



**Fig. 19 Input Speed Sensor Location**

1 - INPUT SPEED SENSOR



**Fig. 20 O-Ring Location**

1 - INPUT SPEED SENSOR

2 - O-RING

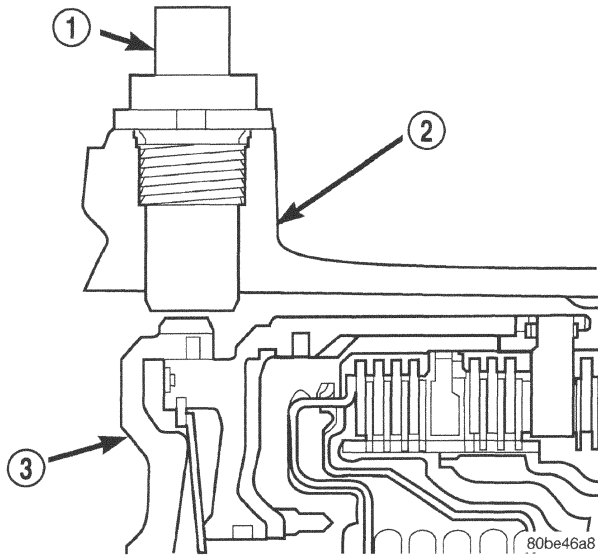
## OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil (Fig. 21), an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The TCM compares the input speed signal with output speed signal to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation



**DESCRIPTION AND OPERATION (Continued)****Fig. 21 Sensor Relation to Input Clutch Hub**

- 1 - INPUT SPEED SENSOR  
2 - TRANSAXLE CASE  
3 - INPUT CLUTCH HUB

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

**OUTPUT SPEED SENSOR****DESCRIPTION**

The Output Speed Sensor is a two-wire magnetic pickup device that generates an AC signal as rotation occurs. It is threaded into the transaxle case (Fig. 22), sealed with an o-ring (Fig. 23), and is considered a primary input to the Transmission Control Module (TCM).

**OPERATION**

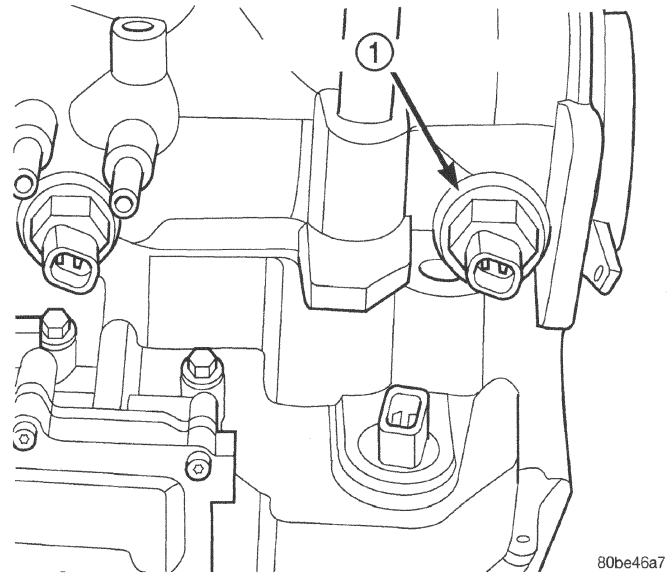
The Output Speed Sensor provides information on how fast the output shaft is rotating. As the rear planetary carrier park pawl lugs pass by the sensor coil (Fig. 24), an AC voltage is generated and sent to the TCM. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

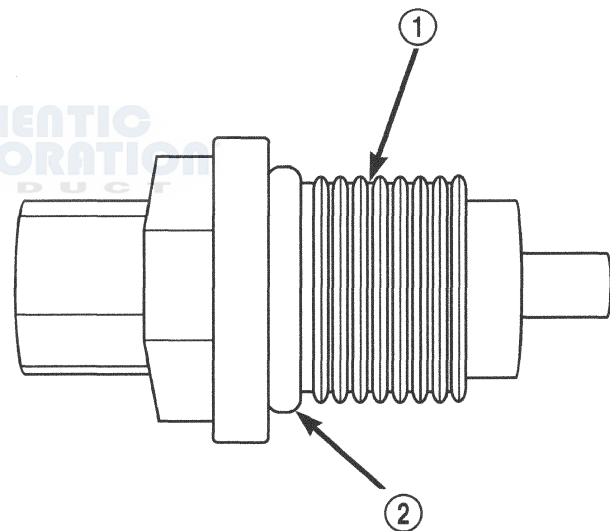
- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

**VEHICLE SPEED SIGNAL**

The vehicle speed signal is taken from the Output Speed Sensor. The TCM converts this signal into a pulse per mile signal and sends it to the PCM. The PCM, in turn, sends the vehicle speed message

**Fig. 22 Output Speed Sensor Location**

- 1 - OUTPUT SPEED SENSOR

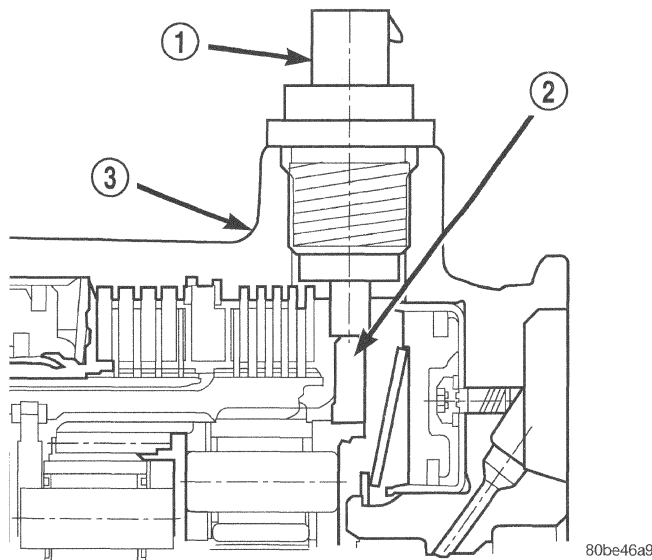
**Fig. 23 O-Ring Location**

- 1 - OUTPUT SPEED SENSOR  
2 - O-RING

across the communication bus to the BCM. The BCM sends this signal to the Instrument Cluster to display vehicle speed to the driver. The vehicle speed signal pulse is roughly 8000 pulses per mile.

**SHIFT POSITION INDICATOR****DESCRIPTION**

The shift position indicator is located in the instrument cluster. It indicates the position of the manual valve lever by illuminating an LED located under the P, R, N, D, 3, or L (or Autostick) gear symbol.

**DESCRIPTION AND OPERATION (Continued)**

**Fig. 24 Sensor Relation to Planet Carrier Park Pawl Lugs**

- 1 - OUTPUT SPEED SENSOR
- 2 - REAR PLANET CARRIER/OUTPUT SHAFT ASSEMBLY
- 3 - TRANSAXLE CASE

**OPERATION**

The Transmission Range Sensor (TRS) sends a signal to the Transmission Control Module (TCM) regarding the position of the manual valve lever. The TCM converts this signal into a Shift Lever Position (SLP) and sends the information to the BCM (Body Control Module) and the instrument cluster.

Refer to Group 8E, Instrument Panel And Gauges for repair procedures.

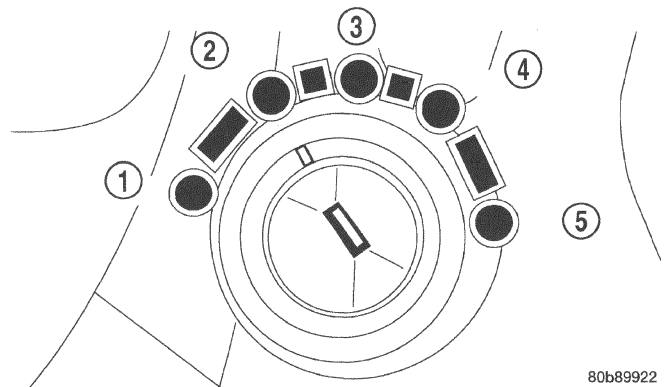
**BRAKE TRANSMISSION SHIFT INTERLOCK SYSTEM****DESCRIPTION**

The Brake Transmission Shifter/Ignition Interlock (BTISI) is a cable and solenoid operated system that prevents the transmission gear shifter from being moved out of PARK without a driver in place.

Refer to the following chart that expected shifter response, depending on ignition key/switch (Fig. 25) and brake pedal positions.

**OPERATION**

The Brake Transmission Shifter/Ignition Interlock (BTISI) is engaged whenever the ignition switch is in the LOCK or ACCESSORY position (Fig. 25). An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed at least one-half inch. A magnetic holding device integral to the interlock cable is energized when the ignition is in the ON/RUN position.



**Fig. 25 Ignition Key/Switch Positions**

- 1 - ACC
- 2 - LOCK
- 3 - OFF
- 4 - ON/RUN
- 5 - START

When the key is in the ON/RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is in the gated PARK position.

The following chart describes the normal operation of the Brake Transmission Shift Interlock (BTISI) system. If the "expected response" differs from the vehicle's response, then system repair and/or adjustment is necessary.

ACTION	EXPECTED RESPONSE
1. Turn key to the "OFF" position.	1. Shifter CAN be shifted out of park.
2. Turn key to the "ON/RUN" position.	2. Shifter CANNOT be shifted out of park.
3. Turn key to the "ON/RUN" position and depress the brake pedal.	3. Shifter CAN be shifted out of park.
4. Leave shifter in any gear and try to return key to the "LOCK" or "ACC" position.	4. Key cannot be returned to the "LOCK" or "ACC" position.
5. Return shifter to "PARK" and try to remove the key.	5. Key can be removed (after returning to "LOCK" position).
6. With the key removed, try to shift out of "PARK".	6. Shifter cannot be shifted out of "PARK".

**NOTE: Any failure to meet these expected responses requires system adjustment or repair.**

**DESCRIPTION AND OPERATION (Continued)****AUTOSTICK****DESCRIPTION**

Autostick is a driver-interactive transaxle feature that offers manual gear shifting capability of an automatic transaxle.

**OPERATION**

When the shifter is moved into the Autostick position, the transaxle remains in whatever gear it was using before Autostick was activated. Moving the shifter to the left (towards the driver) causes a downshift and moving to the right (towards the passenger)

causes an upshift. The instrument cluster will illuminate the selected gear. The vehicle can be launched in 1st, 2nd, or 3rd gear while in the Autostick mode. The speed control is operable in 3rd and 4th gear Autostick mode. Speed control will be deactivated if the transaxle is shifted to 2nd gear. Shifting into OD position cancels the Autostick mode, and the transaxle resumes the OD shift schedule.

**AUTOMATIC OVERRIDES**

For safety, durability, and driveability, some shifts are executed automatically or prevented.

**AUTOMATIC SHIFTS WILL OCCUR UNDER THE FOLLOWING CONDITIONS**

TYPE OF SHIFT	APPROXIMATE SPEED
4-3 coast downshift	13 mph
3-2 coast downshift	9 mph
2-1 coast downshift	5 mph
1-2 upshift	6300 engine rpm
2-3 upshift	6300 engine rpm
4-3 kickdown shift	13-47 mph w/sufficient throttle

**MANUAL SHIFTS ARE NOT PERMITTED UNDER THE FOLLOWING CONDITIONS**

TYPE OF SHIFT	APPROXIMATE SHIFT POINT
3-4 upshift	Below 15 mph
3-2 downshift	Above 74 mph @ closed throttle or 70 mph otherwise
2-1 downshift	Above 41 mph @ closed throttle or 38 mph otherwise



## DIAGNOSIS AND TESTING

### 41TE TRANSAXLE GENERAL DIAGNOSIS

**CAUTION:** Before attempting any repair on a 41TE four speed automatic transaxle, check for Diagnostic Trouble Codes with the DRB scan tool. Always use the Transmission Diagnostic Procedures Manual.

Transaxle malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions
- Mechanical malfunctions
- Electronic malfunctions

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, gearshift cable adjustment. Then perform a road test to determine if the problem has been corrected or that more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

### ROAD TEST

Prior to performing a road test, verify that the fluid level, fluid condition, and linkage adjustment have been approved.

During the road test, the transaxle should be operated in each position to check for slipping and any variation in shifting.

If the vehicle operates properly at highway speeds, but has poor acceleration, the converter stator overrunning clutch may be slipping. If acceleration is normal, but high throttle opening is needed to maintain highway speeds, the converter stator clutch may have seized. Both of these stator defects require replacement of the torque converter and thorough transaxle cleaning.

Slipping clutches can be isolated by comparing the "Elements in Use" chart with clutch operation encountered on a road test. This chart identifies which clutches are applied at each position of the selector lever.

A slipping clutch may also set a DTC and can be determined by operating the transaxle in all selector positions.

#### ELEMENTS IN USE AT EACH POSITION OF SELECTOR LEVER

Shift Lever Position	INPUT CLUTCHES			HOLDING CLUTCHES	
	Underdrive	Overdrive	Reverse	2/4	Low/Reverse
P - PARK					X
R - REVERSE			X		X
N - NEUTRAL					X
OD - OVERDRIVE					
First	X				X
Second	X			X	
Direct	X	X			
Overdrive		X		X	
D - DRIVE*					
First	X				X
Second	X			X	
Direct	X	X			
L - LOW*					
First	X				X
Second	X			X	
Direct	X	X			

\* Vehicle upshift and downshift speeds are increased when in these selector positions.



## DIAGNOSIS AND TESTING (Continued)

The process of elimination can be used to detect any unit which slips and to confirm proper operation of good units. Road test analysis can diagnose slipping units, but the cause of the malfunction cannot be determined. Practically any condition can be caused by leaking hydraulic circuits or sticking valves.

### HYDRAULIC PRESSURE TESTS

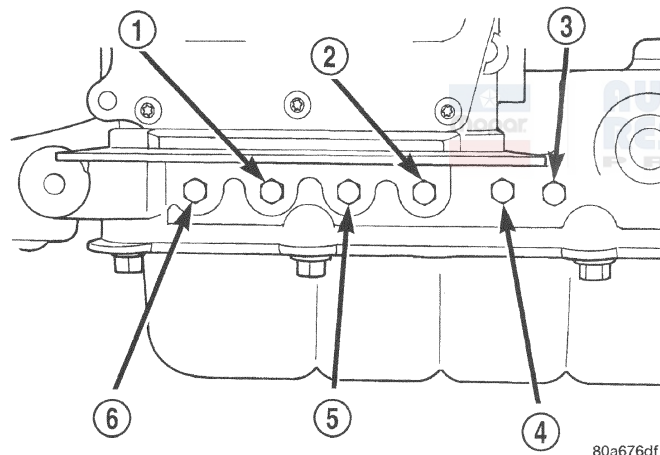
Pressure testing is a very important step in the diagnostic procedure. These tests usually reveal the cause of most hydraulic transaxle problems.

Before performing pressure tests, be certain that fluid level and condition, and shift cable adjustments have been checked and approved. Fluid must be at operating temperature (150 to 200 degrees F.).

Install an engine tachometer, raise vehicle on hoist which allows front wheels to turn, and position tachometer so it can be read.

Attach 300 psi gauge (C-3293SP) to port(s) required for test(s) being conducted. Use adapter set L-4559 to adapt gauge(s) to transaxle.

Test port locations are shown in (Fig. 26).



**Fig. 26 Pressure Taps**

- 1 - OVERDRIVE CLUTCH
- 2 - TORQUE CONVERTER OFF
- 3 - LOW/REVERSE CLUTCH
- 4 - 2/4 CLUTCH
- 5 - REVERSE CLUTCH
- 6 - UNDERDRIVE CLUTCH

### TEST ONE-SELECTOR IN LOW (1st GEAR)

- (1) Attach pressure gauge to the low/reverse clutch tap.
- (2) Move selector lever to the (L) position.
- (3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed to 20 mph.
- (4) Low/reverse clutch pressure should read 115 to 145 psi.

(5) This test checks pump output, pressure regulation and condition of the low/reverse clutch hydraulic circuit and shift schedule.

### TEST TWO-SELECTOR IN DRIVE (2nd GEAR)

**NOTE:** This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

- (1) Attach gauge to the underdrive clutch tap.
- (2) Move selector lever to the 3 position.
- (3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph.
- (4) In second gear the underdrive clutch pressure should read 110 to 145 psi.

### TEST TWO A-SELECTOR IN OD (4th Gear)

**NOTE:** This test checks the underdrive clutch hydraulic circuit as well as the shift schedule.

- (1) Attach gauge to the underdrive clutch tap.
- (2) Move selector lever to the (OD) position.
- (3) Allow wheels to rotate freely and increase throttle opening to achieve an indicated speed of 40 mph.
- (4) Underdrive clutch pressure should read below 5 psi. If not, then either the solenoid assembly or TCM is at fault.

### TEST THREE-OVERDRIVE CLUTCH CHECK (3rd and 2nd Gear)

- (1) Attach gauge to the overdrive clutch tap.
- (2) Move selector lever to the (OD) position.
- (3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 20 mph. Vehicle should be in 3rd gear.
- (4) Overdrive clutch pressure should read 74 to 95 psi.
- (5) Move selector lever to the (3) position and increase indicated vehicle speed to 30 mph.
- (6) The vehicle should be in second gear and overdrive clutch pressure should be less than 5 psi.
- (7) This test checks the overdrive clutch hydraulic circuit as well as the shift schedule.

### TEST FOUR-SELECTOR IN OVERDRIVE (4th Gear)

- (1) Attach gauge to the 2/4 clutch tap.
- (2) Move selector lever to the (OD) position.
- (3) Allow vehicle front wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 30 mph. Vehicle should be in 4th gear.
- (4) The 2/4 clutch pressure should read 75 to 95 psi.
- (5) This test checks the 2/4 clutch hydraulic circuit.

**DIAGNOSIS AND TESTING (Continued)****TEST FIVE-SELECTOR IN OVERDRIVE (4th Gear-CC on)**

(1) Attach gauge to the torque converter clutch off pressure tap.

(2) Move selector lever to the (OD) position.

(3) Allow vehicle wheels to turn and increase throttle opening to achieve an indicated vehicle speed of 50 mph. Vehicle should be in 4th gear, CC on.

**CAUTION: Both wheels must turn at the same speed.**

(4) Torque converter clutch off pressure should be less than 5 psi.

(5) This test checks the torque converter clutch hydraulic circuit.

**TEST SIX-SELECTOR IN REVERSE**

(1) Attach gauges to the reverse and LR clutch tap.

(2) Move selector lever to the (R) position.

(3) Read reverse clutch pressure with output stationary (foot on brake) and throttle opened to achieve 1500 rpm.

(4) Reverse and LR clutch pressure should read 165 to 235 psi.

(5) This test checks the reverse clutch hydraulic circuit.

**TEST RESULT INDICATIONS**

(1) If proper line pressure is found in any one test, the pump and pressure regulator are working properly.

(2) Low pressure in all positions indicates a defective pump, a clogged filter, or a stuck pressure regulator valve.

(3) Clutch circuit leaks are indicated if pressures do not fall within the specified pressure range.

(4) If the overdrive clutch pressure is greater than 5 psi in Step 4 of Test Three, a worn reaction shaft seal ring or a defective solenoid assembly is indicated.

(5) If the underdrive clutch pressure is greater than 5 psi in Step 4 of Test Two A, a defective solenoid assembly or TCM is the cause.

**PRESSURE CHECK SPECIFICATIONS**

Gear Selector Position	Actual Gear	Pressure Taps					
		Underdrive Clutch	Overdrive Clutch	Reverse Clutch	Torque Converter Clutch Off	2/4 Clutch	Low/Reverse Clutch
Park * 0 mph	PARK	0-2	0-5	0-2	60-110	0-2	115-145
REVERSE * 0 mph	REVERSE	0-2	0-7	165-235	50-100	0-2	165-235
NEUTRAL * 0 mph	NEUTRAL	0-2	0-5	0-2	60-110	0-2	115-145
L # 20 mph	FIRST	110-145	0-5	0-2	60-110	0-2	115-145
3 # 30 mph	SECOND	110-145	0-5	0-2	60-110	115-145	0-2
3 # 45 mph	DIRECT	75-95	75-95	0-2	60-90	0-2	0-2
OD # 30 mph	OVERDRIVE	0-2	75-95	0-2	60-90	75-95	0-2
OD # 50 mph	OVERDRIVE WITH TCC	0-2	75-95	0-2	0-5	75-95	0-2

\* Engine speed at 1500 rpm

# CAUTION: Both front wheels must be turning at the same speed.

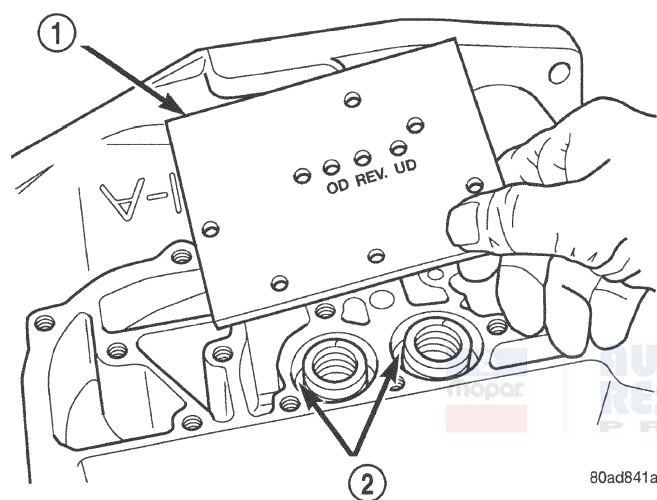
## DIAGNOSIS AND TESTING (Continued)

### CLUTCH AIR PRESSURE TESTS

Inoperative clutches can be located using a series of tests by substituting air pressure for fluid pressure (Fig. 27) (Fig. 28). The clutches may be tested by applying air pressure to their respective passages. The valve body must be removed and Tool 6056 installed. To make air pressure tests, proceed as follows:

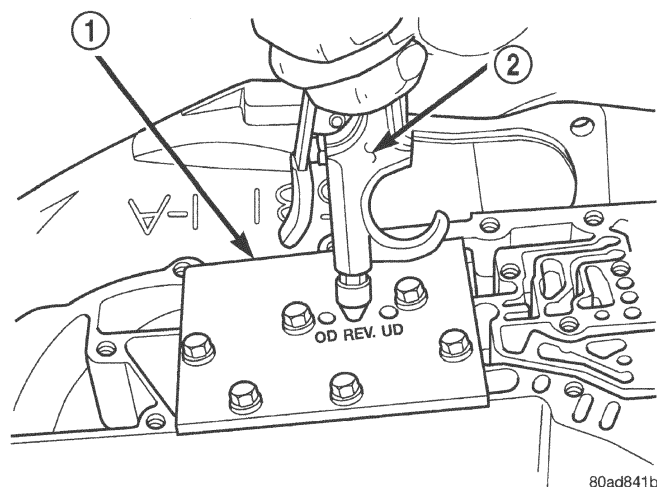
**NOTE:** The compressed air supply must be free of all dirt and moisture. Use a pressure of 30 psi.

Remove oil pan and valve body. See Valve body removal.



**Fig. 27 Air Pressure Test Plate**

- 1 - TOOL 6056
- 2 - ACCUMULATORS



**Fig. 28 Testing Reverse Clutch**

- 1 - TOOL 6056
- 2 - AIR NOZZLE

### OVERDRIVE CLUTCH

Apply air pressure to the overdrive clutch apply passage and watch for the push/pull piston to move forward. The piston should return to its starting position when the air pressure is removed.

### REVERSE CLUTCH

Apply air pressure to the reverse clutch apply passage and watch for the push/pull piston to move rearward. The piston should return to its starting position when the air pressure is removed.

### 2/4 CLUTCH

Apply air pressure to the feed hole located on the 2/4 clutch retainer. Look in the area where the 2/4 piston contacts the first separator plate and watch carefully for the 2/4 piston to move rearward. The piston should return to its original position after the air pressure is removed.

### LOW/REVERSE CLUTCH

Apply air pressure to the low/reverse clutch feed hole (rear of case, between 2 bolt holes). Then, look in the area where the low/reverse piston contacts the first separator plate. Watch carefully for the piston to move forward. The piston should return to its original position after the air pressure is removed.

### UNDERDRIVE CLUTCH

Because this clutch piston cannot be seen, its operation is checked by function. Air pressure is applied to the low/reverse and the 2/4 clutches. This locks the output shaft. Use a piece of rubber hose wrapped around the input shaft and a pair of clamp-on pliers to turn the input shaft. Next apply air pressure to the underdrive clutch. The input shaft should not rotate with hand torque. Release the air pressure and confirm that the input shaft will rotate.

### FLUID LEAKAGE-TORQUE CONVERTER HOUSING AREA

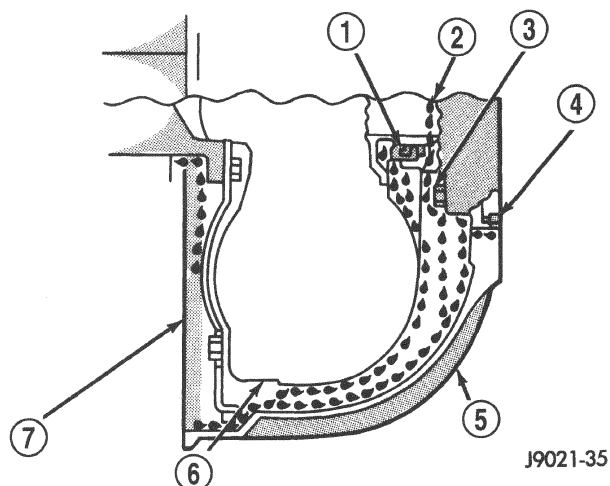
When diagnosing converter housing fluid leaks, three actions must be taken before repair:

- (1) Verify proper transmission fluid level.
- (2) Verify that the leak originates from the converter housing area and is transmission fluid.
- (3) Determine the true source of the leak.

Fluid leakage at or around the torque converter area may originate from an engine oil leak (Fig. 29). The area should be examined closely. Factory fill fluid is red and, therefore, can be distinguished from engine oil.

Some suspected converter housing fluid leaks may not be leaks at all. They may only be the result of residual fluid in the converter housing, or excess fluid spilled during factory fill, or fill after repair.



**DIAGNOSIS AND TESTING (Continued)****Fig. 29 Converter Housing Leak Paths**

- 1 - PUMP SEAL
- 2 - PUMP VENT
- 3 - PUMP BOLT
- 4 - PUMP GASKET
- 5 - CONVERTER HOUSING
- 6 - CONVERTER
- 7 - REAR MAIN SEAL LEAK

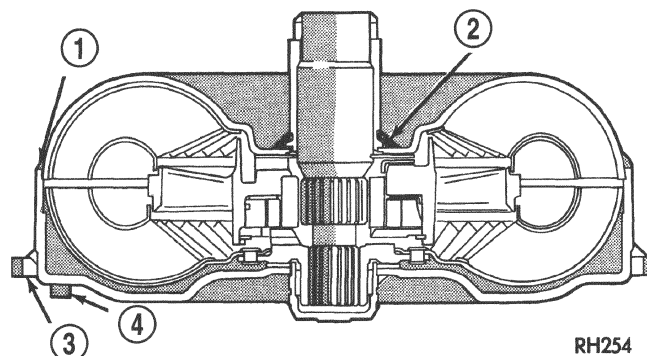
Converter housing leaks have several potential sources. Through careful observation, a leak source can be identified before removing the transmission for repair.

Pump seal leaks tend to move along the drive hub and onto the rear of the converter (Fig. 29). Pump o-ring or pump body leaks follow the same path as a seal leak. Pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself. Pump seal or gasket leaks usually travel down the inside of the converter housing (Fig. 29).

**TORQUE CONVERTER LEAKAGE**

Possible sources of torque converter leakage are:

- Torque converter weld leaks at the outside diameter weld (Fig. 30).
- Torque converter hub weld (Fig. 30).

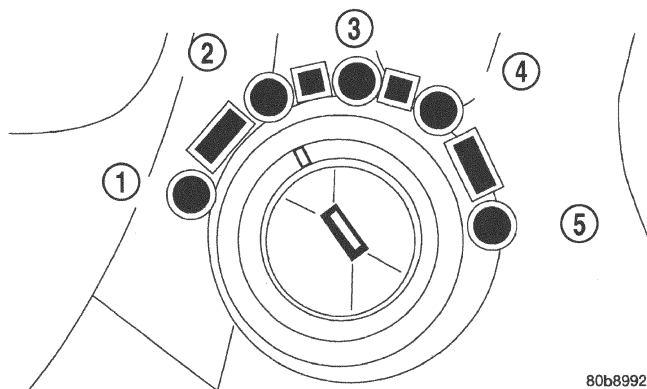
**Fig. 30 Converter Leak Points—Typical**

- 1 - OUTSIDE DIAMETER WELD
- 2 - TORQUE CONVERTER HUB WELD
- 3 - STARTER RING GEAR
- 4 - LUG

**BRAKE/TRANSMISSION SHIFT INTERLOCK SYSTEM**

The following chart describes the normal operation of the Brake Transmission Shift Interlock (BTSI) system. If the "expected response" differs from the vehicle's response, then system repair and/or adjustment is necessary.

Refer to the following chart that expected shifter response, depending on ignition key/switch (Fig. 31) and brake pedal positions.

**Fig. 31 Ignition Key/Switch Positions**

- 1 - ACC
- 2 - LOCK
- 3 - OFF
- 4 - ON/RUN
- 5 - START



**DIAGNOSIS AND TESTING (Continued)**

ACTION	EXPECTED RESPONSE
1. Turn key to the "OFF" position.	1. Shifter CAN be shifted out of park.
2. Turn key to the "ON/RUN" position.	2. Shifter CANNOT be shifted out of park.
3. Turn key to the "ON/RUN" position and depress the brake pedal.	3. Shifter CAN be shifted out of park.
4. Leave shifter in any gear and try to return key to the "LOCK" or "ACC" position.	4. Key cannot be returned to the "LOCK" or "ACC" position.
5. Return shifter to "PARK" and try to remove the key.	5. Key can be removed (after returning to "LOCK" position).
6. With the key removed, try to shift out of "PARK".	6. Shifter cannot be shifted out of "PARK".
<b>NOTE: Any failure to meet these expected responses requires system adjustment or repair.</b>	

**SHIFT POSITION INDICATOR**

The transmission range sensor (on the valve body) sends a signal to the TCM on the position of the transaxle manual valve lever. The TCM receives the switch signal and processes the data. The TCM sends the Shift Lever Position (SLP) information to the BCM via the communication bus. The BCM then outlines the appropriate shifter position indicator in the instrument cluster.

If a problem arises with the shifter position indicator, consult the following chart for diagnostic information. If the malfunction cannot be corrected using the chart, consult the proper diagnostic manual.

To replace the shifter position indicator, refer to Group 8E, Instrument Panel And Gauges.

**AUTOSTICK**

The autostick feature will be deactivated if one of the following conditions occur:

- DTC P0705—Check Shifter Signal—usually accompanied by all PRNDL lights turning on in Park and Neutral. This will result in a DTC P0705 if three such errors are detected after any one "key-on".
- DTC P1796—Autostick Input Circuit
- DTC P1797—Manual Shift Overheat—(Transmission oil temperature >275° F) or (Engine coolant temperature >255° F).

Acceptable powertrain temperature must be achieved to reactivate Autostick after a high temperature fault:

- Transmission Oil Temperature <255° F
- Engine Coolant Temperature <240° F

CONDITION	POSSIBLE CAUSE
ALL PRND3L (PRND1234 if Autostick equipped) DISPLAY LIGHTS "ON" IN P&N GEAR POSITIONS	Check wiring and connectors
	Faulty TRS
	Faulty manual lever
ALL DISPLAY LIGHTS "ON" IN ALL GEAR POSITIONS	Check wiring & connectors
	Faulty trans. range sensor
	Faulty manual lever
	Communication bus malfunction
ALL DISPLAY LIGHTS "OFF"	Normal transient condition between P&R and R&N gear positions
	Check shift lever linkage
	BCM malfunction
	Check wiring and connectors
	Faulty instrument cluster
ALL DISPLAY LIGHTS "OFF" ACCOMPANIED BY A "NO BUS" MESSAGE	Communication bus malfunction
DISPLAY LIGHTS OUT OF SEQUENCE WITH SHIFT LEVER	Check wiring and connectors
	Faulty TRS
	Faulty manual lever
	Communication bus malfunction

**SERVICE PROCEDURES****FLUID LEVEL AND CONDITION CHECK**

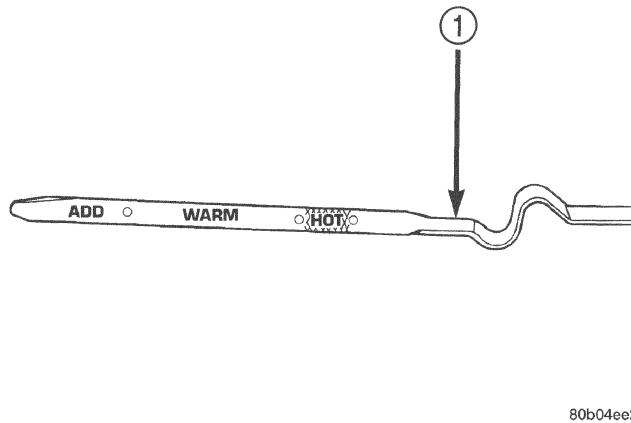
**NOTE:** Only transmission fluid of the type labeled Mopar ATF+4 (Automatic Transmission Fluid—Type 9602) should be used in this transaxle.

**FLUID LEVEL CHECK**

The transmission sump has a fluid level indicator (dipstick) to check oil similar to most automatic transmissions. It is located on the left side of the engine. Be sure to wipe all dirt from dipstick handle before removing.

## SERVICE PROCEDURES (Continued)

The torque converter fills in both the P Park and N Neutral positions. Place the selector lever in P Park to be sure that the fluid level check is accurate. **The engine should be running at idle speed for at least one minute, with the vehicle on level ground.** At normal operating temperature (approximately 82 C. or 180 F.), the fluid level is correct if it is in the HOT region (cross-hatched area) on the oil level indicator (Fig. 32). The fluid level will be approximately one-quarter inch above the lower hole of the dipstick at 70° F fluid temperature.



**Fig. 32 Fluid Level Indicator Markings**

1 - TRANSAXLE DIPSTICK

### FLUID LEVEL CHECK USING DRB

**NOTE:** Engine and Transaxle should be at normal operating temperature before performing this procedure.

- (1) Start engine and apply parking brake.
- (2) Hook up DRB scan tool and select transmission.
- (3) Select sensors.
- (4) Read the transmission temperature value.
- (5) Compare the fluid temperature value with the chart.
- (6) Adjust transmission fluid level shown on the dipstick according to the chart.
- (7) Check transmission for leaks.

Low fluid level can cause a variety of conditions because it allows the pump to take in air along with the fluid. As in any hydraulic system, air bubbles make the fluid spongy, therefore, pressures will be low and build up slowly.

Improper filling can also raise the fluid level too high. When the transaxle has too much fluid, the gears churn up foam and cause the same conditions which occur with a low fluid level.

In either case, air bubbles can cause overheating and/or fluid oxidation, and varnishing. This can interfere with normal valve, clutch, and accumulator

operation. Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

### FLUID CONDITION

Along with fluid level, it is important to check the condition of the fluid. When the fluid smells burned, and is contaminated with metal or friction material particles, a complete transaxle recondition is needed. Be sure to examine the fluid on the dipstick closely. If there is any doubt about its condition, drain out a sample for a double check.

Mopar® ATF+4 (Automatic Transmission Fluid-Type 9602) when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. This is normal. A dark brown/black fluid accompanied with a burnt odor and/or deterioration in shift quality may indicate fluid deterioration or transmission component failure.

After the fluid has been checked, seat the dipstick fully to seal out water and dirt.

## TRANSAXLE FLUID AND FILTER SERVICE

**NOTE:** Refer to the maintenance schedules in Group 0, Lubrication and Maintenance, or the vehicle owner's manual, for the recommended maintenance (fluid/filter change) intervals for this transaxle.

**NOTE:** Only fluids of the type labeled Mopar® ATF+4 (Automatic Transmission Fluid) Type 9602 should be used. A filter change should be made at the time of the transmission oil change. The magnet (on the inside of the oil pan) should also be cleaned with a clean, dry cloth.

**NOTE:** If the transaxle is disassembled for any reason, the fluid and filter should be changed.

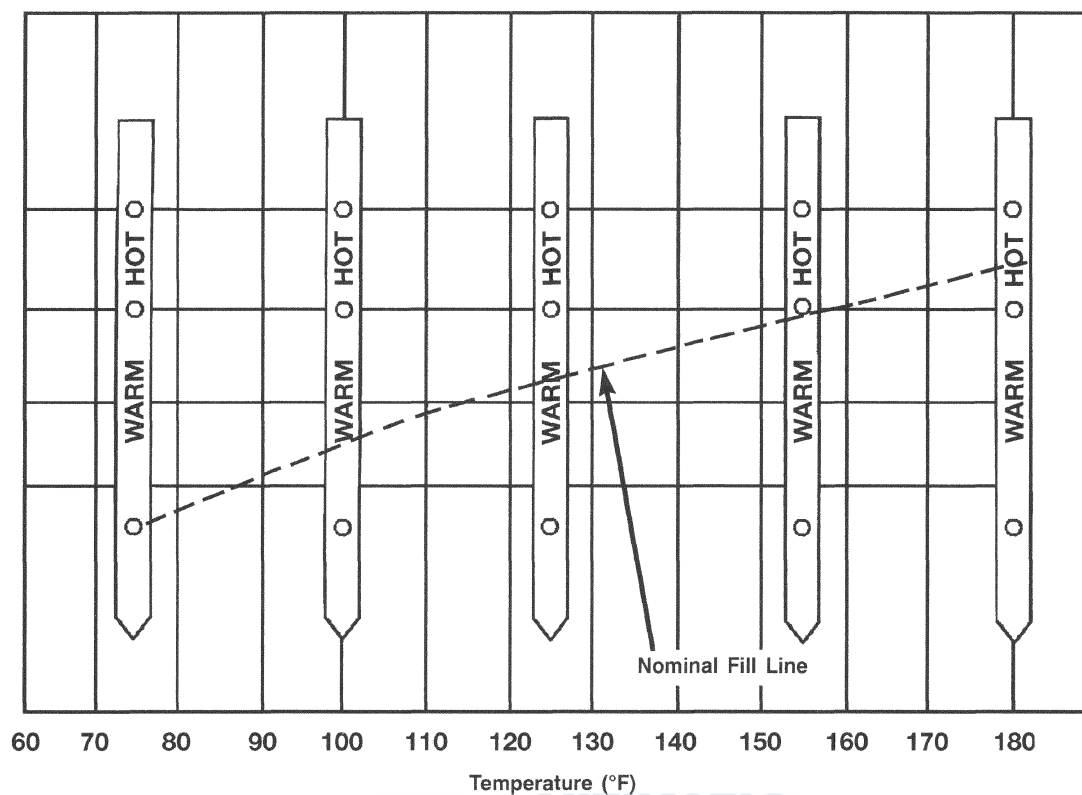
### FLUID/FILTER SERVICE (RECOMMENDED)

(1) Raise vehicle on a hoist (See Lubrication, Group 0). Place a drain container with a large opening, under transaxle oil pan.

(2) Loosen pan bolts and tap the pan at one corner to break it loose allowing fluid to drain, then remove the oil pan.

(3) Install a new filter and o-ring on bottom of the valve body (Fig. 33).

## SERVICE PROCEDURES (Continued)



Transmission Fluid Temperature Chart

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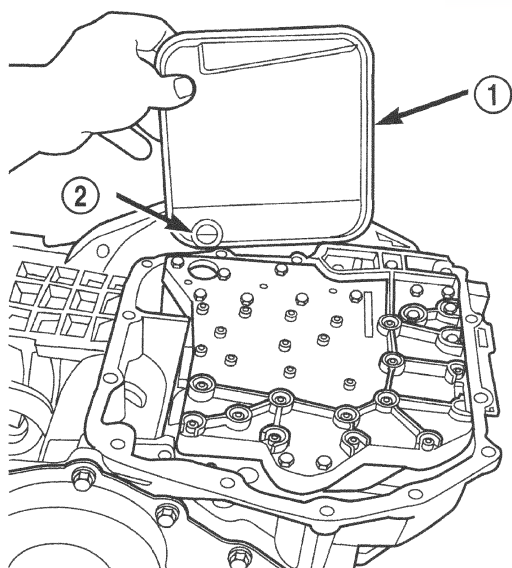


Fig. 33 Filter and O-Ring

- 1 - OIL FILTER  
2 - O-RING

(4) Clean the oil pan and magnet. Reinstall pan using new Mopar Silicone Adhesive sealant. Tighten oil pan bolts to 19 N·m (165 in. lbs.).

(5) Pour four quarts of Mopar® ATF+4 (Automatic Transmission Fluid) Type 9602 through the dipstick opening.

(6) Start engine and allow to idle for at least one minute. Then, with parking and service brakes applied, move selector lever momentarily to each position, ending in the park or neutral position.

(7) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the "ADD" mark on the dipstick (Fig. 34).

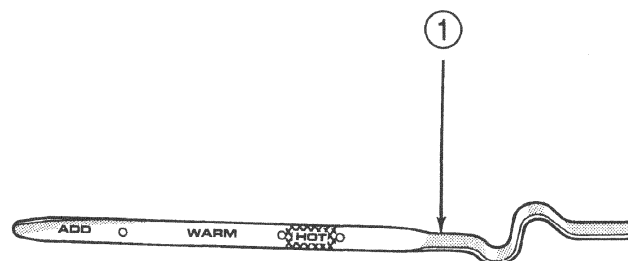


Fig. 34 Dipstick Markings

- 1 - TRANSAXLE DIPSTICK

9321-323



## SERVICE PROCEDURES (Continued)

(8) Recheck the fluid level after the transaxle has reached normal operating temperature (180°F.). Refer to Fluid Level and Condition Check in this group for the proper fluid fill procedure.

(9) To prevent dirt from entering transaxle, make certain that dipstick is fully seated into the dipstick opening.

## ALTERNATIVE MAINTENANCE METHODS

### TRANSAXLE FLUID EXCHANGER METHOD

**CAUTION:** The use of any fluid exchanger that introduces additives into the transaxle is not recommended.

(1) To perform the transaxle fluid exchange, the transaxle must be at operating temperature. Drive the vehicle until it reaches full operating temperature.

(2) Obtain a suitable transaxle fluid exchanger and verify the tank is clean and dry.

(3) Fill the tank to the recommended fill capacity with Mopar® ATF+4 Type 9602.

(4) Connect the machine to the vehicle following the manufacturers instructions. Perform the exchange procedure following the instructions provided with the machine.

(5) Once machine has completed the fluid exchange. Check the fluid level and condition and fill to proper level with Mopar® ATF+4 Type 9602. Refer to Fluid Level and Condition Check in this group for the proper fluid fill procedure.

**NOTE:** Verify that the transaxle cooler lines are tightened to proper specifications. Cooler line torque specification is 2 N•m (18 in. lbs.).

### DIPSTICK TUBE FLUID SUCTION METHOD

(1) When performing the fluid suction method, make sure the transaxle is at full operating temperature.

(2) To perform the dipstick tube fluid suction method, use a suitable fluid suction device (Vacula™ or equivalent).

(3) Insert the fluid suction line into the dipstick tube.

**NOTE:** Verify that the suction line is inserted to the lowest point of the transaxle oil pan. This will ensure complete evacuation of the fluid in the pan.

(4) Follow the manufacturers recommended procedure and evacuate the fluid from the transaxle.

(5) Remove the suction line from the dipstick tube.

(6) Pour four quarts of Mopar® ATF+4 (Automatic Transmission Fluid) Type 9602 through the dipstick opening.

(7) Start engine and allow to idle for at least one minute. Then, with parking and service brakes applied, move selector lever momentarily to each position, ending in the park or neutral position.

(8) Check the transaxle fluid level and add an appropriate amount to bring the transaxle fluid level to 3mm (1/8 in.) below the "ADD" mark on the dipstick (Fig. 34).

(9) Recheck the fluid level after the transaxle has reached normal operating temperature (180°F.). Refer to Fluid Level and Condition Check in this group for the proper fluid fill procedure.

(10) To prevent dirt from entering transaxle, make certain that dipstick is fully seated into the dipstick opening.

## ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transaxle case and valve body can be repaired by the use of Heli-Coils, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil tap, or equivalent, and installing a Heli-Coil insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

## FLUSHING COOLERS AND TUBES

When a transaxle failure has contaminated the fluid, the oil cooler(s) must be flushed. The cooler bypass valve in the transaxle must be replaced also. The torque converter must also be replaced with an exchange unit. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transaxle.

The recommended procedure for cooler flushing is to use Tool 6906 Cooler Flusher.



**SERVICE PROCEDURES (Continued)**

**WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1-1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.**

**KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.**

**KEEP THE AREA WELL VENTILATED.**

**DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.**

(1) Remove cover plate filler plug on Tool 6906. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

**NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.**

(4) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(5) Connect the CLEAR return line to the INLET (To) cooler line

(6) Turn pump ON for two to three minutes to flush cooler and lines.

(7) Turn pump OFF.

(8) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(9) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(10) Place CLEAR suction line into a one quart container of Mopar® ATF+4 (Automatic Transmission Fluid—Type 9602).

(11) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(12) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

**OIL PUMP VOLUME CHECK**

Measuring oil pump output volume will determine if sufficient flow to the transmission oil cooler exists, and whether or not an internal transmission failure is present.

Verify that transmission fluid is at the proper level. Refer to Fluid Level and Condition in this Group. If adding fluid is necessary, fill to the proper level with Mopar® ATF+4 (Automatic Transmission Fluid—Type 9602). The following procedure is to check oil pump output volume:

(1) Disconnect the **To cooler** line at the oil cooler inlet and place a collecting container under the disconnected line.

**CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.**

(2) Start engine and run **at curb idle speed**, with the shift selector in neutral.

(3) If one quart of ATF is collected in 20 seconds or less, flow is within acceptable limits. If fluid flow is intermittent or it takes more than 20 seconds to collect one quart of ATF, refer to Hydraulic Pressure Tests in this Group.

(4) Inspect the cooler hose for damage. Replace if necessary.

(5) Connect the **To cooler** hose to the oil cooler inlet and torque clamp to 2 N·m (20 in. lbs.) torque.

(6) Refill the transaxle to proper level with Mopar® ATF+4 (Automatic Transmission Fluid—Type 9602).

**TRANSAXLE QUICK LEARN PROCEDURE**

The quick learn procedure requires the use of the DRB scan tool.

This program allows the electronic transaxle system to recalibrate itself. This will provide the best possible transaxle operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transaxle Assembly Replacement
- Transmission Control Module Replacement
- Solenoid/Pressure Switch Assembly Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:

- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than 3 degrees
- The shift lever position must stay until prompted to shift to overdrive

## SERVICE PROCEDURES (Continued)

- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the DRB indicates the procedure is complete

- The calculated oil temperature must be above 60° and below 200°

(1) Plug the DRB scan tool into the data link connector. The connector is located under the instrument panel.

(2) Go to the Transmission screen.

(3) Go to the Miscellaneous screen.

(4) Select Quick Learn Procedure. Follow the instructions of the DRB to perform the Quick Learn Procedure.

## PINION FACTOR PROCEDURE

The vehicle speed readings for the speedometer are taken from the output speed sensor. The TCM must be calibrated to the different combinations of equipment available. Pinion Factor allows the technician to set the Transmission Control Module initial setting so that the speedometer readings will be correct.

Failure to perform this procedure will cause a No Speedometer Operation condition.

This procedure must be performed if the Transmission Control Module has been replaced.

To properly read or reset the Pinion Factor, it is necessary to use a DRB scan tool. Perform the following steps with the DRB scan tool to read or reset the Pinion Factor:

(1) Plug the DRB scan tool into the data link connector located under the instrument panel.

(2) Select the Transmission menu.

(3) Select the Miscellaneous menu.

(4) Select Pinion Factor. Then follow the instructions on the DRB scan tool screen.

## REMOVAL AND INSTALLATION

### GEARSHIFT CABLE

#### REMOVAL

(1) Place transaxle in PARK.

(2) Disconnect battery negative cable at left strut tower.

(3) Remove air cleaner assembly.

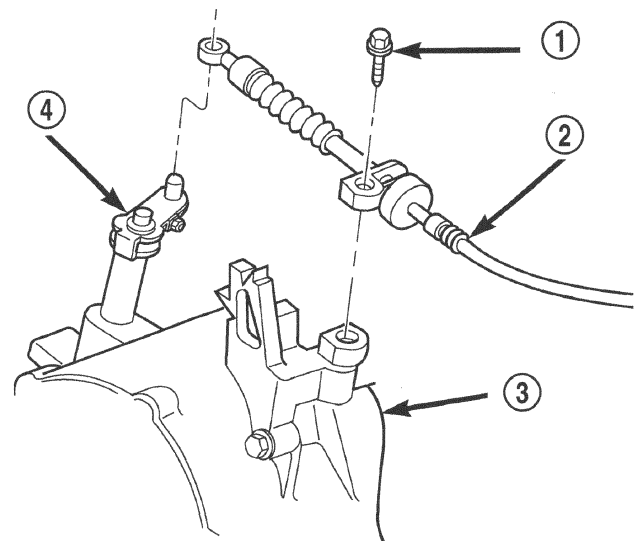
(4) Disconnect battery positive cable.

(5) Disconnect Transmission Control Module (TCM) connector. Remove TCM.

(6) Pull Power Distribution Center (PDC) up and out of the way.

(7) Using a pry tool, pry up on cable at manual valve lever and remove cable from lever (Fig. 35).

(8) Remove the screw from the cable bracket at the transaxle (Fig. 35).

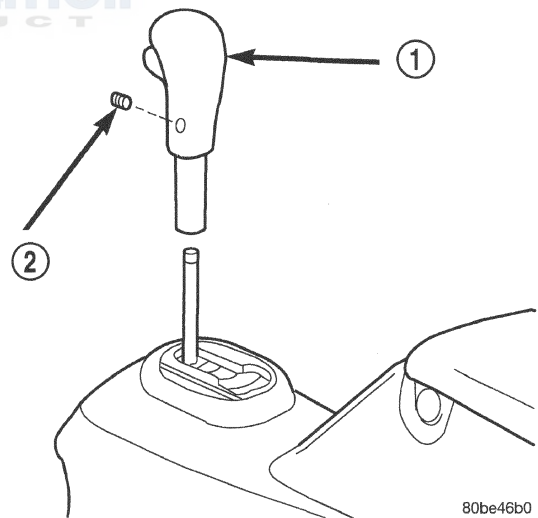


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**Fig. 35 Gearshift Cable at Transaxle**

- 1 - SCREW
- 2 - CABLE
- 3 - TRANSAXLE
- 4 - SHIFT LEVER

(9) Remove the gearshift knob set screw and knob (Fig. 36).



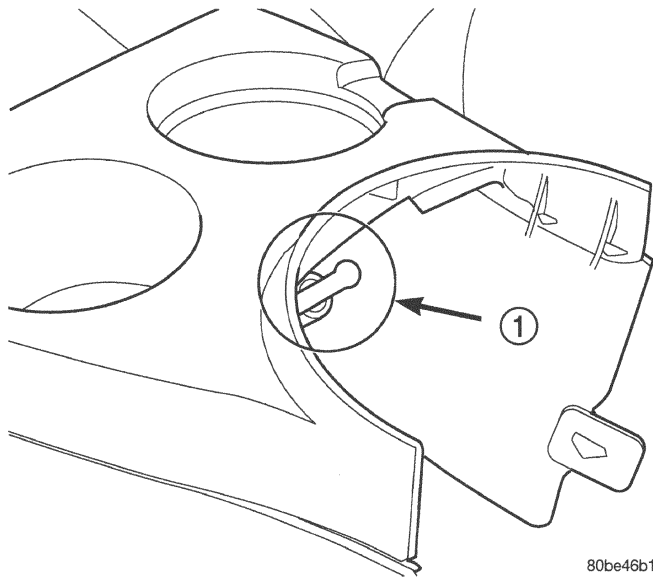
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**Fig. 36 Shifter Knob Removal/Installation**

- 1 - SHIFTER KNOB
- 2 - SET SCREW

(10) Remove the floor console (rear). Refer to Group 23, Body for the proper procedures.

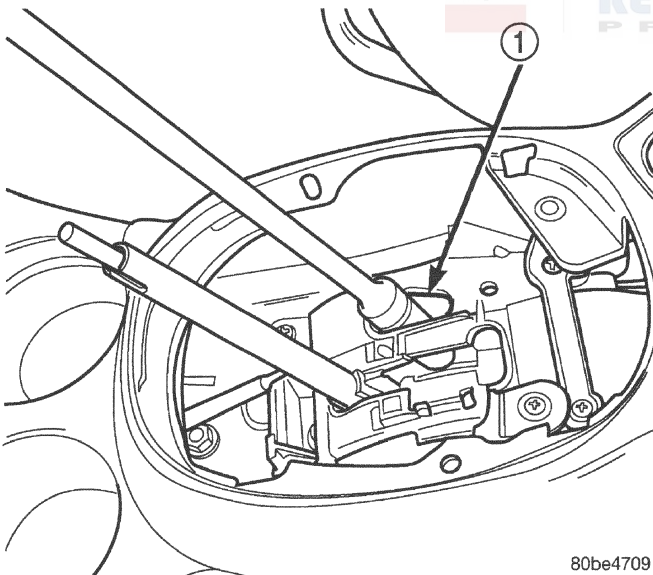
**CAUTION:** When removing forward console, the console will contact nylon shift release plunger (Fig. 37). If care is not used, plunger may break, requiring shifter assembly replacement.

**REMOVAL AND INSTALLATION (Continued)****Fig. 37 Console/Shifter Contact Area**

1 - AREA OF CONTACT

(11) Remove the forward IP console (front). Refer to Group 23, Body for the proper procedures.

(12) Loosen nut on shift cable adjust lever (Fig. 38).

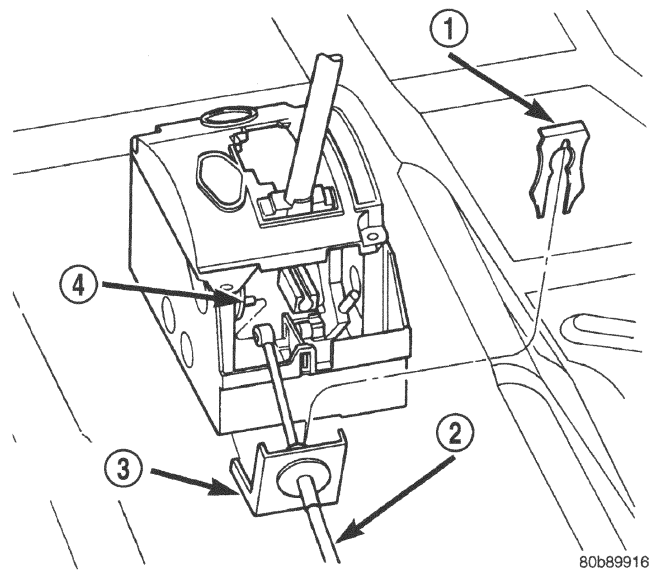
**Fig. 38 Shift Cable Adjust Lever Nut**

1 - ACCESS HOLE

(13) Using a flat blade pry tool, remove the shifter cable core end from the shift lever pin (Fig. 39).

(14) Using a flat blade pry tool, pry the cable conduit clip up from the shifter bracket. Pull up on the cable conduit and remove from bracket (Fig. 39).

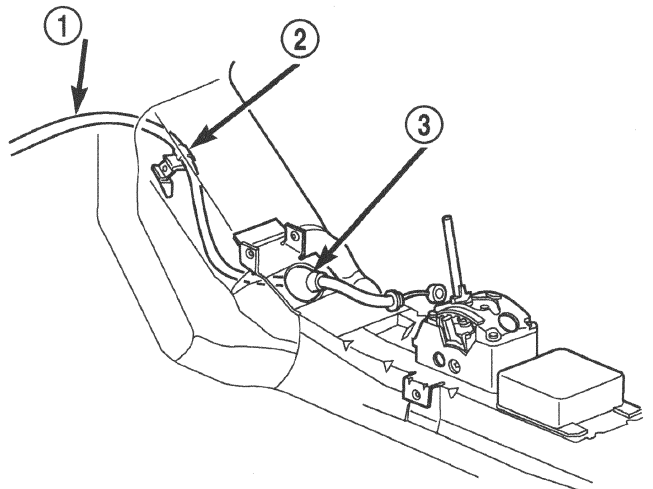
(15) Hoist vehicle. Refer to Group 0, Lubrication and Maintenance.

**Fig. 39 Gearshift Cable at Floor Shifter—Typical**

- 1 - CLIP
- 2 - CABLE
- 3 - CONDUIT BRACKET
- 4 - SHIFT PIN

(16) Remove the cable grommet from the floor pan area (Fig. 40).

(17) Carefully remove the cable from the underbody by unfolding the cable retainer clip (Fig. 40) as you go along.

**Fig. 40 Gearshift Cable Routing**

- 1 - CABLE
- 2 - RETAINER CLIP
- 3 - GROMMET



## REMOVAL AND INSTALLATION (Continued)

### INSTALLATION

(1) Install cable assy. into floor pan tunnel hole and secure grommet. If necessary, use a synthetic based lubricant to aid in grommet installation.

(2) Position cable into retainer clip (Fig. 40) and tighten clip to secure cable. Route cable up towards transaxle shift lever.

(3) Lower vehicle.

(4) Install cable to transaxle and tighten screw to 14 N·m (125 in. lbs.) (Fig. 35).

(5) Install cable to transaxle shift lever (Fig. 35).

(6) Connect cable to shifter conduit bracket and shift pin. Install cable retaining clip (Fig. 39).

(7) Verify transaxle shift lever and floor shifter lever are in the PARK position.

(8) Tighten cable adjuster nut (Fig. 38) to 23 N·m (200 in. lbs.).

**CAUTION:** When installing forward console, the console will contact nylon shift release plunger (Fig. 37). If care is not used, plunger may break, requiring shifter assembly replacement.

(9) Reinstall forward and rear floor consoles. Refer to Group 23, Body, for the proper procedures.

(10) Install gearshift knob (Fig. 36) and tighten set screw to 2 N·m (20 in.lbs.).

(11) Verify proper cable adjustment. Engine starter should only engage in PARK and NEUTRAL gear shifter positions. If adjustment is required, refer to Gearshift Linkage Adjustment in this group.

## GEARSHIFT ASSEMBLY

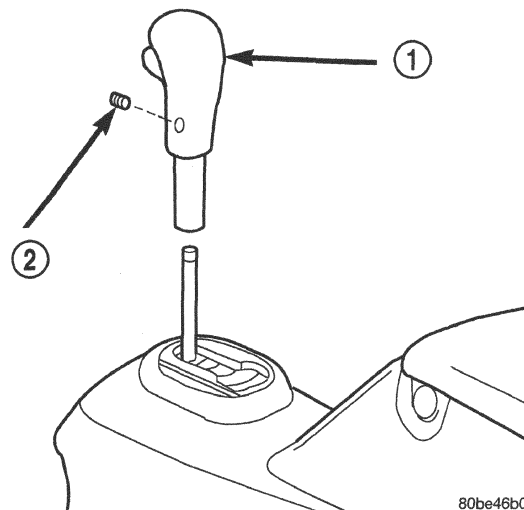
### REMOVAL

(1) Disconnect negative battery cable and isolate.

(2) Remove the gearshift knob set screw and knob (Fig. 41).

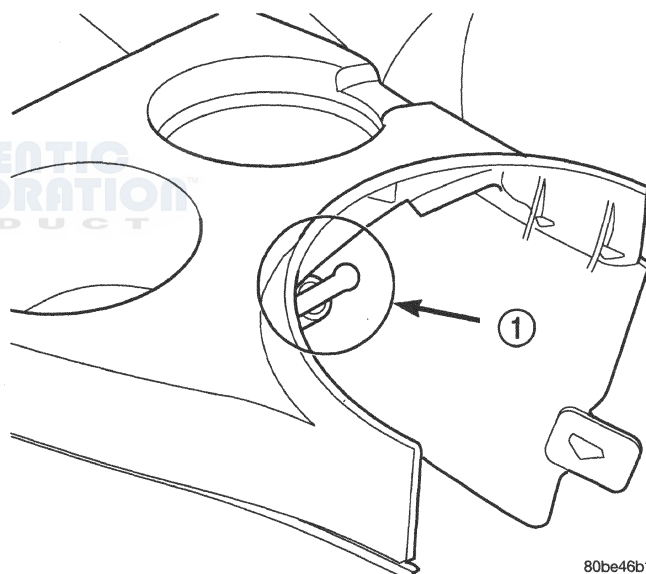
(3) Remove the floor console (rear). Refer to Group 23, Body for the proper procedures.

**CAUTION:** When removing forward console, the console will contact nylon shift release plunger (Fig. 42). If care is not used, plunger may break, requiring shifter assembly replacement.



**Fig. 41 Shifter Knob Removal/Installation**

- 1 - SHIFTER KNOB  
2 - SET SCREW



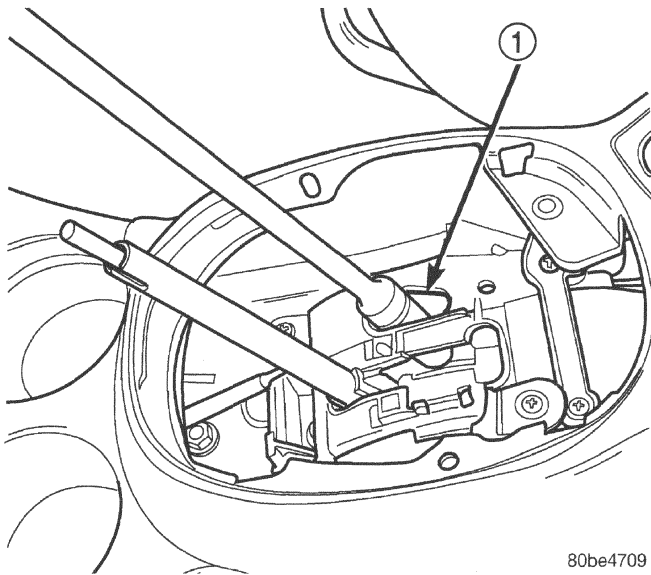
**Fig. 42 Console/Shifter Contact Area**

- 1 - AREA OF CONTACT

(4) Remove the forward IP console (front). Refer to Group 23, Body for the proper procedures.

(5) Loosen nut on shift cable adjust lever (Fig. 43).

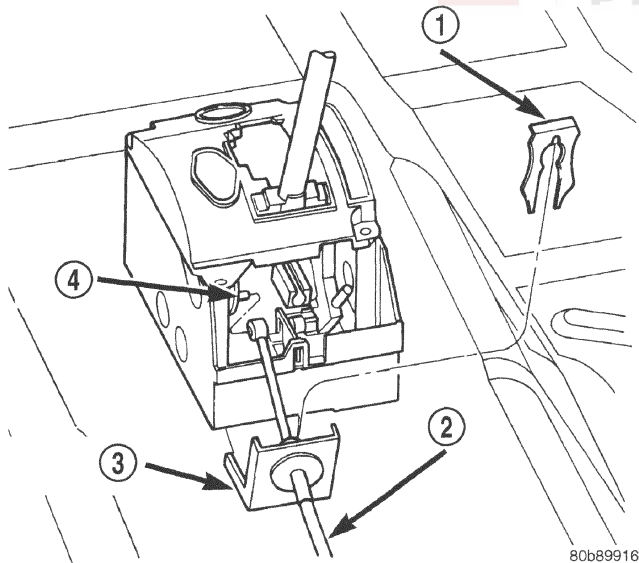


**REMOVAL AND INSTALLATION (Continued)****Fig. 43 Shift Cable Adjust Lever Nut**

1 - ACCESS HOLE

(6) Using a flat blade pry tool, remove the shifter cable core end from the shift lever pin (Fig. 44).

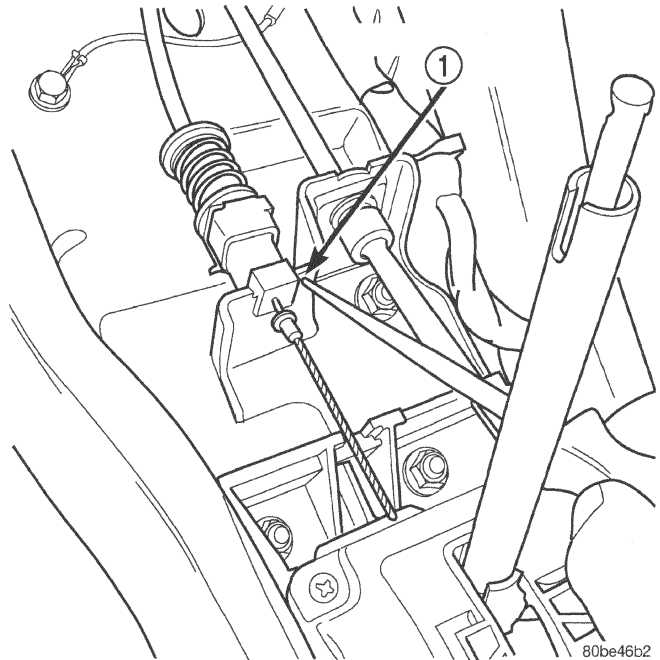
(7) Using a flat blade pry tool, pry the cable conduit clip up from the shifter bracket. Pull up on the cable conduit and remove from bracket (Fig. 44).

**Fig. 44 Gearshift Cable at Floor Shifter—Typical**

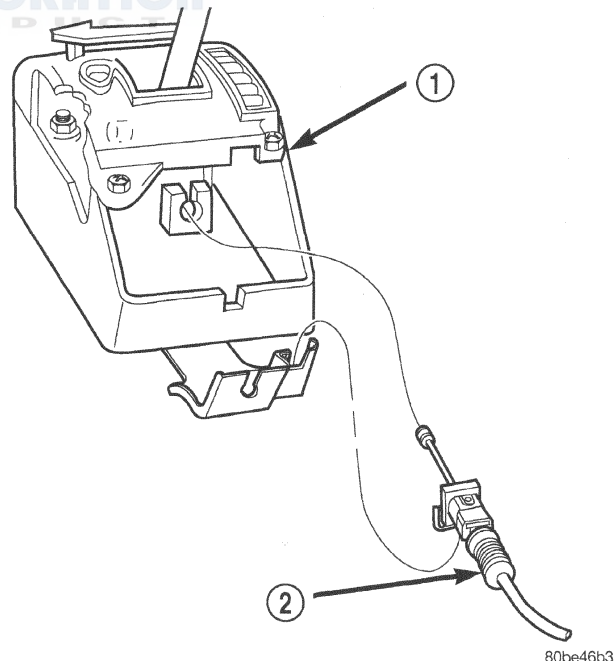
- 1 - CLIP
- 2 - CABLE
- 3 - CONDUIT BRACKET
- 4 - SHIFT PIN

(8) Release interlock cable adjuster end by inserting pointed object into shift bracket to disengage lock (Fig. 45). Unsnap the shifter/ignition interlock cable adjuster end from the slot in the gearshift mecha-

nism bracket and disconnect cable core from shifter assembly (Fig. 46).

**Fig. 45 Release Cable from Bracket at Retainer Lock**

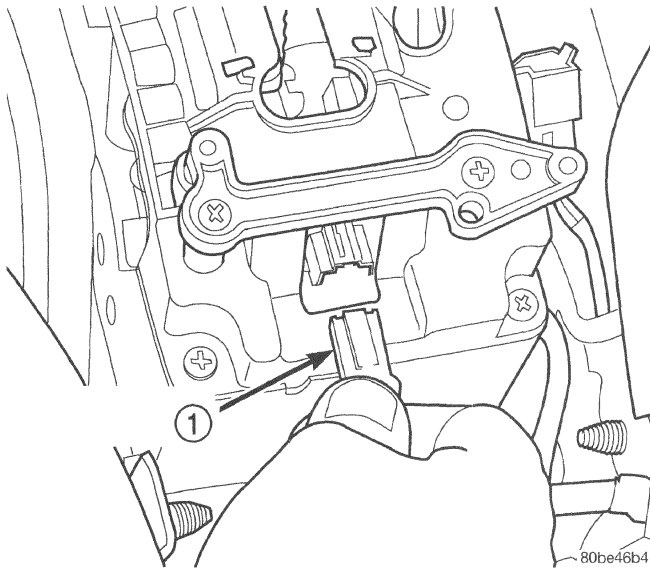
1 - RELEASE CABLE HERE

**Fig. 46 Interlock Cable at Floor Shifter Assembly**

- 1 - SHIFTER ASSEMBLY
- 2 - INTERLOCK CABLE

## REMOVAL AND INSTALLATION (Continued)

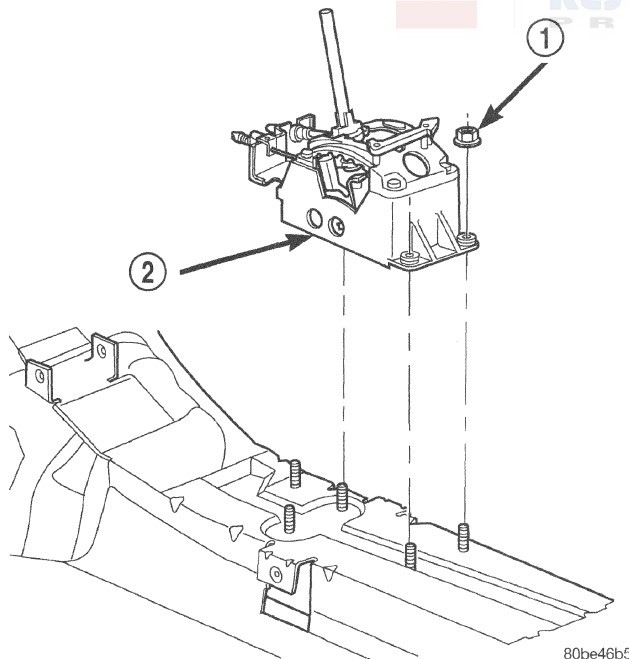
- (9) Disconnect Autostick connector (if equipped) (Fig. 47).



**Fig. 47 Autostick Connector (if equipped)**

1 – AUTOSTICK CONNECTOR

- (10) Remove the five nuts at the base of the shifter assembly. Remove assembly from vehicle (Fig. 48).



**Fig. 48 Shifter Assembly**

1 – NUTS (5)  
2 – SHIFTER ASSEMBLY

## INSTALLATION

- (1) Install shifter assembly (Fig. 48). Tighten the nuts to 17 N·m (150 in. lbs.).
- (2) Install gearshift cable into conduit bracket and onto shift pin. Install retainer clip (Fig. 44).
- (3) Tighten cable adjuster nut (Fig. 43) to 23 N·m (200 in. lbs.).
- (4) Insert interlock cable core wire into interlock adjustment lever groove. Make sure the interlock cable slug is seated in the groove (Fig. 46).
- (5) Insert interlock cable adjuster end into bracket and snap into place (Fig. 46).
- (6) Adjust the gearshift and interlock cables. Refer to Adjustments in this group.

**NOTE:** Gearshift and Interlock cables **MUST** be adjusted. Refer to the Adjustments section in this group for proper procedures.

- (7) If equipped with Autostick, connect the Autostick connector (Fig. 47).

**CAUTION:** When installing forward console, the console will contact nylon shift release plunger (Fig. 42). If care is not used, plunger may break, requiring shifter assembly replacement.

- (8) Install the forward IP console (front). Refer to Group 23, Body for the proper procedures.
- (9) Install the floor console (rear). Refer to Group 23, Body for the proper procedures.
- (10) Install the gearshift knob and tighten set screw (Fig. 41) to 2 N·m (20 in.lbs.).
- (11) Connect the battery negative cable.

## AUTOSTICK

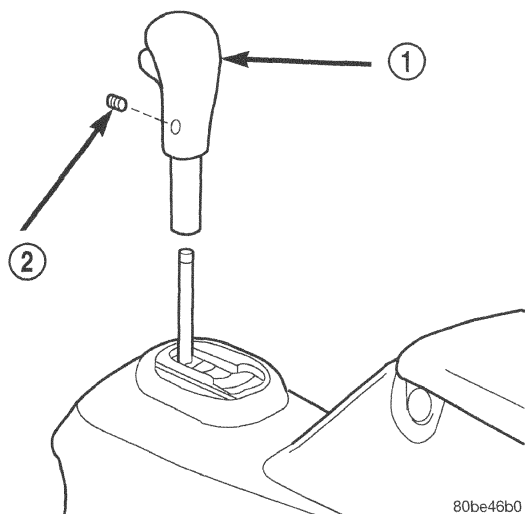
The autostick switch mechanism is incorporated into the gearshift mechanism. If the switch needs to be replaced, the gearshift mechanism must be replaced. To replace the autostick switch, refer to Gearshift Mechanism Replacement in this section.

## BRAKE/TRANSMISSION SHIFT INTERLOCK CABLE

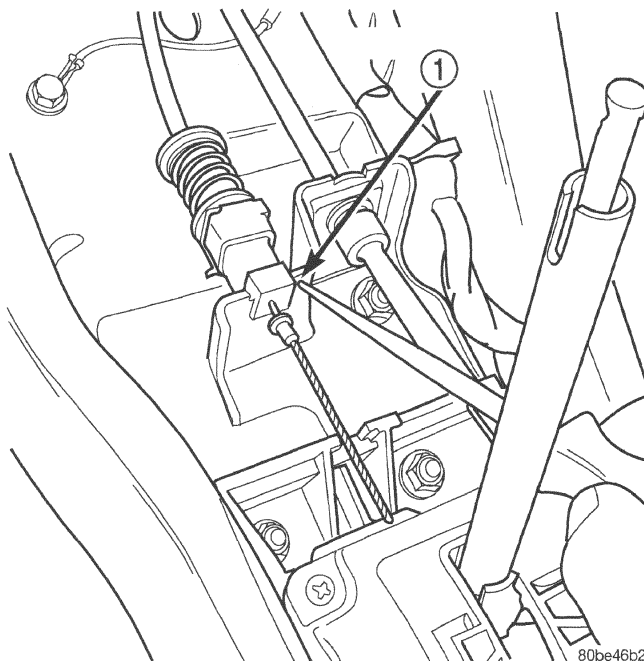
### REMOVAL

- (1) Disconnect and isolate the battery negative cable.
- (2) Remove the gearshift knob set screw and knob (Fig. 49).
- (3) Remove the floor console (rear). Refer to Group 23, Body for the proper procedures.

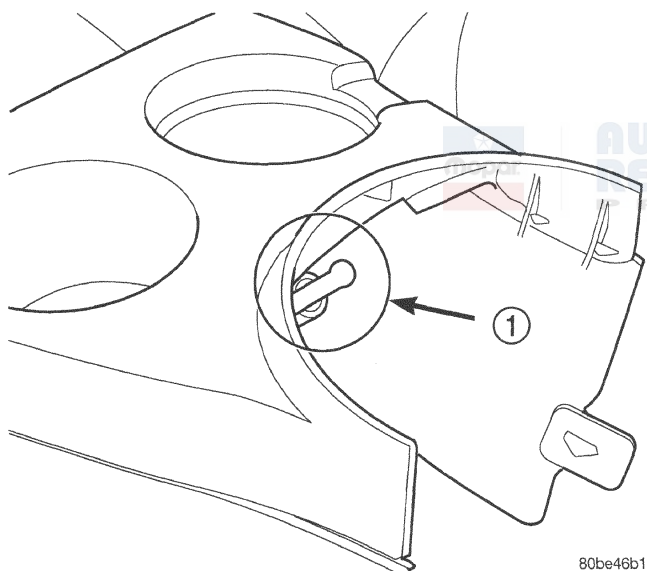
**CAUTION:** When removing forward console, the console will contact nylon shift release plunger (Fig. 50). If care is not used, plunger may break, requiring shifter assembly replacement.

**REMOVAL AND INSTALLATION (Continued)****Fig. 49 Shifter Knob Removal/Installation**

- 1 - SHIFTER KNOB  
2 - SET SCREW

**Fig. 51 Release Cable from Bracket at Retainer Lock**

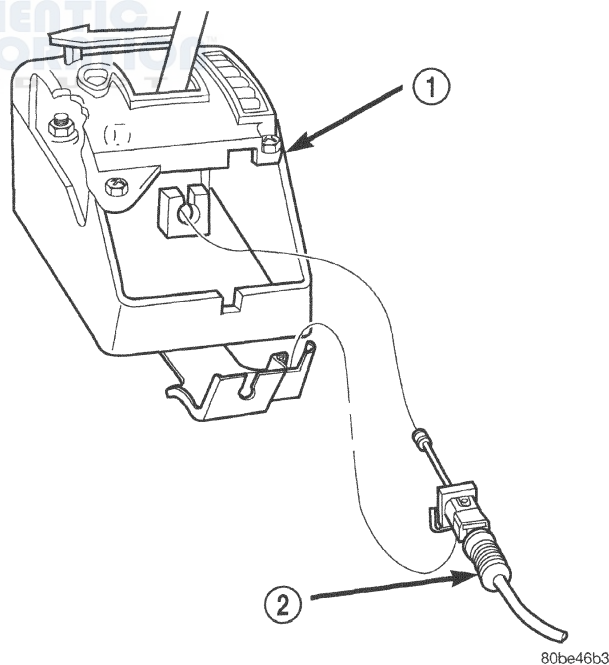
- 1 - RELEASE CABLE HERE

**Fig. 50 Console/Shifter Contact Area**

- 1 - AREA OF CONTACT

(4) Remove the forward IP console (front). Refer to Group 23, Body for the proper procedures.

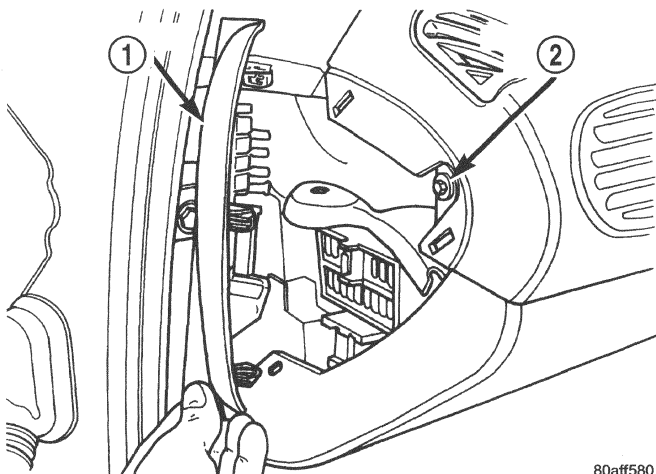
(5) Release interlock cable adjuster end by inserting pointed object into shift bracket to disengage lock (Fig. 51). Unsnap the shifter/ignition interlock cable adjuster end from the slot in the gearshift mechanism bracket and disconnect cable core from shifter assembly (Fig. 52).

**Fig. 52 Interlock Cable at Floor Shifter Assembly**

- 1 - SHIFTER ASSEMBLY  
2 - INTERLOCK CABLE

**REMOVAL AND INSTALLATION (Continued)**

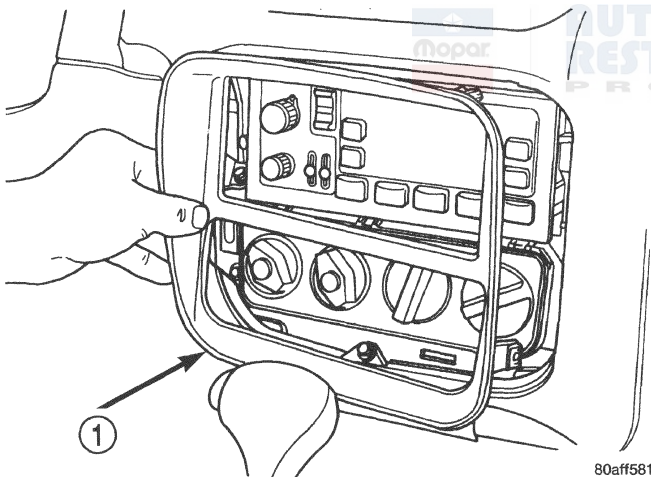
(6) Remove fuse panel cover from left end of instrument panel. Remove screw holding end of instrument panel top cover (Fig. 53).



**Fig. 53 Instrument Panel Top Cover-Left Side**

- 1 - FUSE PANEL COVER  
2 - TOP COVER SCREW

(7) Pull center bezel off (Fig. 54).

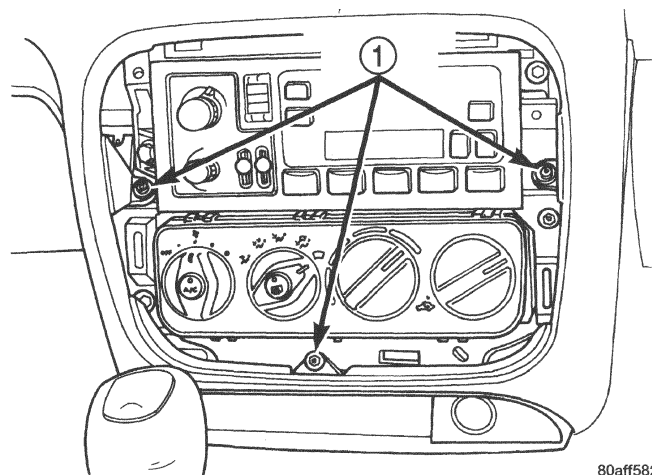


**Fig. 54 Center Bezel**

- 1 - CENTER BEZEL

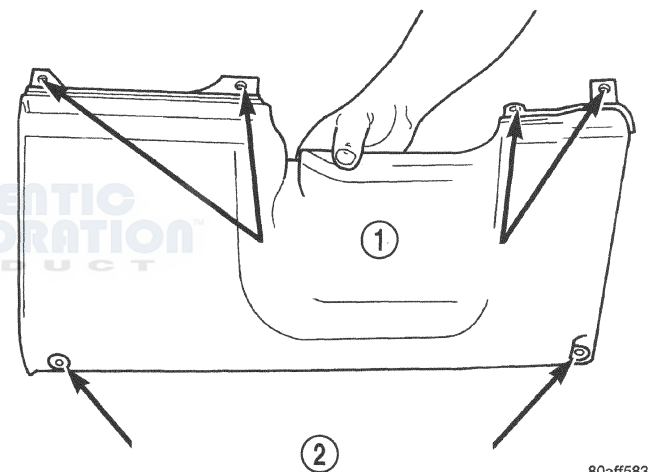
(8) Remove screws holding instrument panel top cover to center of instrument panel (Fig. 55).

(9) Pull instrument panel top cover up enough to gain access to knee bolster screws (Fig. 56).



**Fig. 55 Instrument Panel Top Cover-Center**

- 1 - TOP COVER SCREWS



**Fig. 56 Knee Bolster Attaching Points**

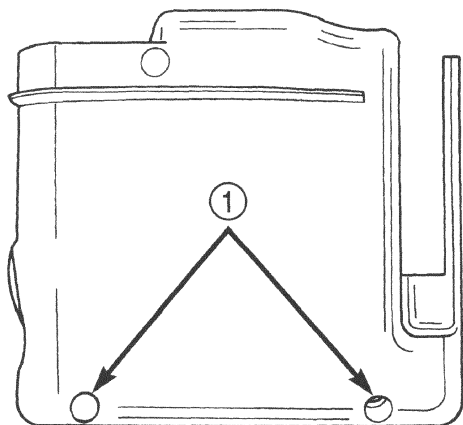
- 1 - KNEE BOLSTER SCREW LOCATIONS UNDER TOP COVER  
2 - LOWER SCREW LOCATIONS

(10) Remove lower knee bolster screws and knee bolster.

(11) Remove screws from lower steering column shroud (Fig. 57).

(12) Pull lower shroud to clear ignition cylinder (Fig. 58).

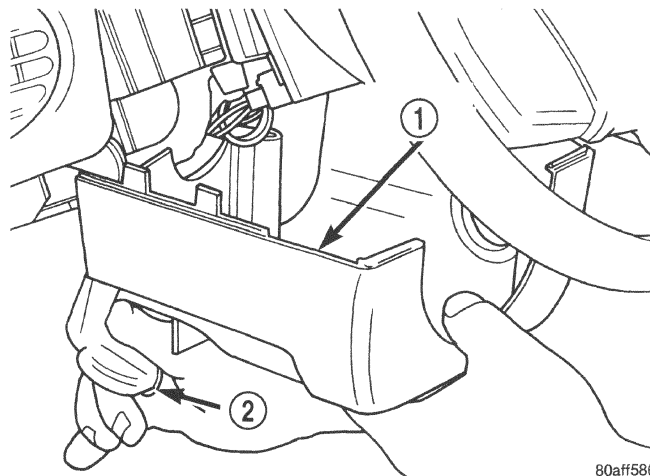


**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 57 Lower Steering Column Shroud Screw Locations**

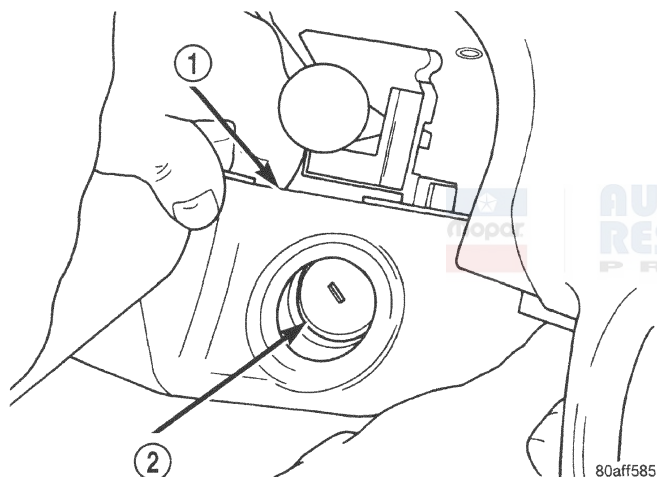
1 - LOWER STEERING COLUMN SHROUD SCREW LOCATIONS



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**Fig. 59 Lower Shroud Removal**

1 - LOWER SHROUD  
2 - TILT LEVER



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**Fig. 58 Remove Lower Shroud From Ignition Cylinder**

1 - LOWER SHROUD  
2 - KEY CYLINDER

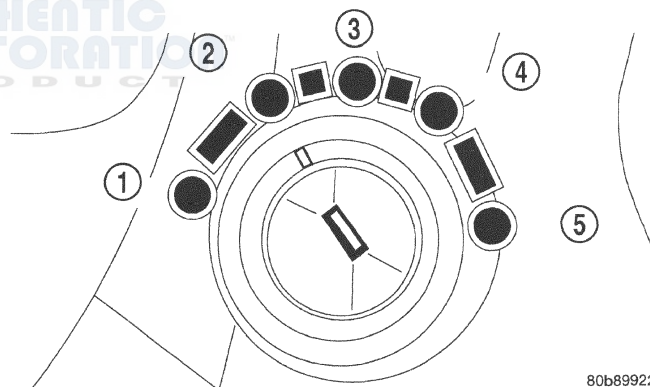
(13) Hold tilt wheel lever down and slide lower shroud forward to remove it from column (Fig. 59).

(14) Tilt wheel to full down position and remove upper steering column shroud.

(15) Disconnect interlock solenoid connector.

(16) Disconnect nylon cable retainer from lower column mounting stud.

(17) Place the ignition key in the ON/RUN position (Fig. 60). Grasp the interlock cable clip and connector. Remove the cable from the interlock housing (Fig. 61).



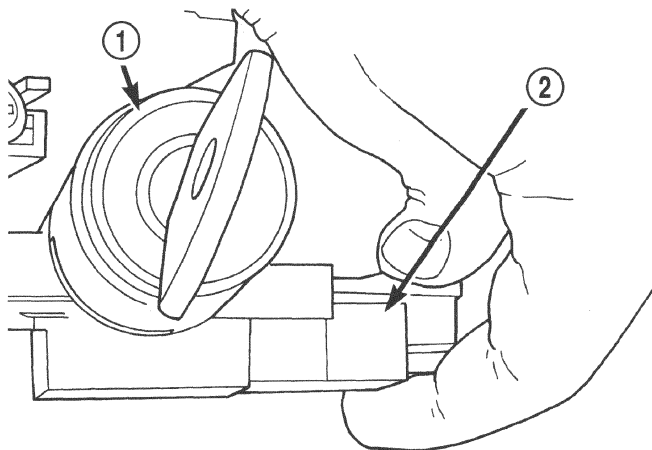
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**Fig. 60 Ignition Key/Switch Positions**

1 - ACC  
2 - LOCK  
3 - OFF  
4 - ON/RUN  
5 - START

(18) Remove interlock cable from underside of instrument panel.

## REMOVAL AND INSTALLATION (Continued)



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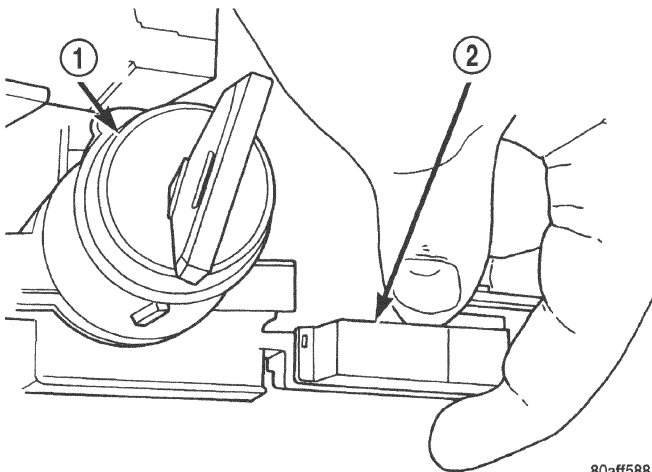
**Fig. 61 Interlock Cable and Connector**

- 1 - IGNITION LOCK CYLINDER  
2 - INTERLOCK CABLE

## INSTALLATION

**CAUTION:** When installing interlock cable assembly, care must be taken not to bend exposed cable wire and slug at shifter end of cable.

- (1) Route interlock cable into lower dash panel and towards console as removed.
- (2) Turn the ignition switch to the ON/RUN position (Fig. 60).
- (3) Install the interlock cable into the interlock housing at the steering column (Fig. 62). Verify the cable snaps into the housing.



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**Fig. 62 Interlock Cable At Housing**

- 1 - IGNITION SWITCH  
2 - INTERLOCK CABLE

- (4) Install nylon cable retainer to lower column mounting stud.
- (5) Connect solenoid connector.

(6) Insert interlock cable core wire into interlock adjustment lever groove. Make sure the interlock cable slug is seated in the groove (Fig. 52).

(7) Insert interlock cable adjuster end into bracket and snap into place (Fig. 52).

**NOTE:** The Interlock Cable **MUST** be adjusted. Refer to Interlock System Adjustment, in this group.

**CAUTION:** When installing forward console, the console will contact nylon shift release plunger (Fig. 50). If care is not used, plunger may break, requiring shifter assembly replacement.

(8) Install the forward IP console (front). Refer to Group 23, Body for the proper procedures.

(9) Install the floor console (rear). Refer to Group 23, Body for the proper procedures.

(10) Install the gearshift knob and tighten set screw (Fig. 49) to 2 N·m (20 in.lbs.).

(11) Tilt wheel to full down position and install upper steering column shroud.

(12) Hold tilt wheel lever down and slide lower shroud in at column.

(13) Install screws at lower steering column shroud.

(14) Install lower knee bolster screws and knee bolster.

(15) Install screws holding instrument panel top cover to center of instrument panel.

(16) Install center bezel.

(17) Install screw holding end of instrument panel top cover. Install fuse panel cover from left end of instrument panel.

(18) Connect the battery negative cable.

## INTERLOCK MECHANISM

### REMOVAL

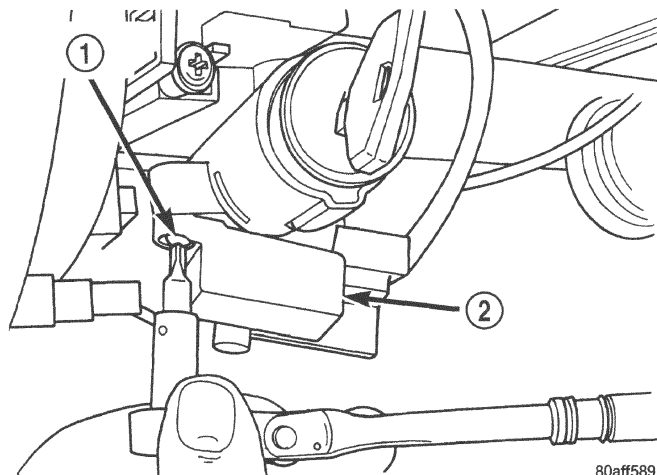
- (1) Remove the lower column covers, knee bolster and shrouds. Refer to Interlock Cable Replacement.
- (2) Grasp the interlock cable and connector firmly. Remove the interlock cable.
- (3) Remove the two interlock mechanism to steering column attaching screws (Fig. 63). Remove the interlock housing.

### INSTALLATION

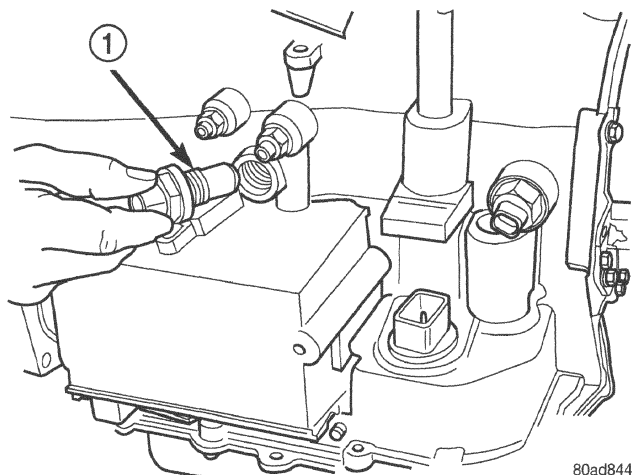
(1) Position the interlock housing at steering column. Install the two interlock mechanism to steering column attaching screws. Torque screws to 3 N·m (21 in. lbs.).

(2) Snap the interlock cable into the housing.

(3) Install the lower column covers, shrouds and knee bolster. Refer to Interlock Cable Replacement.

**REMOVAL AND INSTALLATION (Continued)****Fig. 63 Interlock Mechanism**

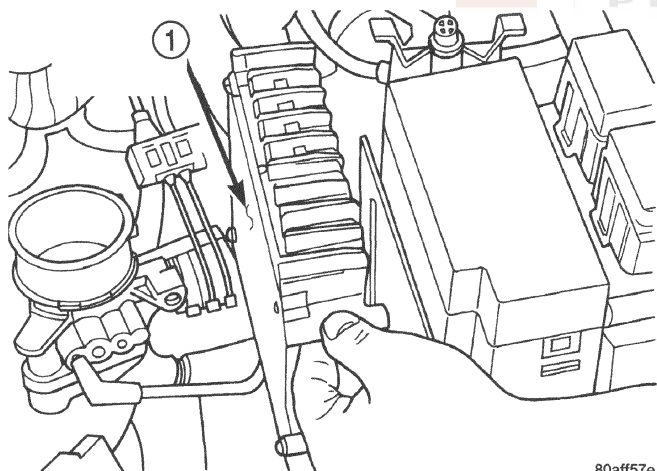
- 1 - MOUNTING SCREW  
2 - INTERLOCK MECHANISM

**Fig. 65 Input Speed Sensor**

- 1 - INPUT (TURBINE) SPEED SENSOR

**SOLENOID/PRESSURE SWITCH ASSEMBLY****REMOVAL**

- (1) Disconnect battery negative cable.
- (2) Remove air cleaner assembly.
- (3) Remove the Transmission Control module (TCM) (Fig. 64).

**Fig. 64 Transmission Control Module (TCM)**

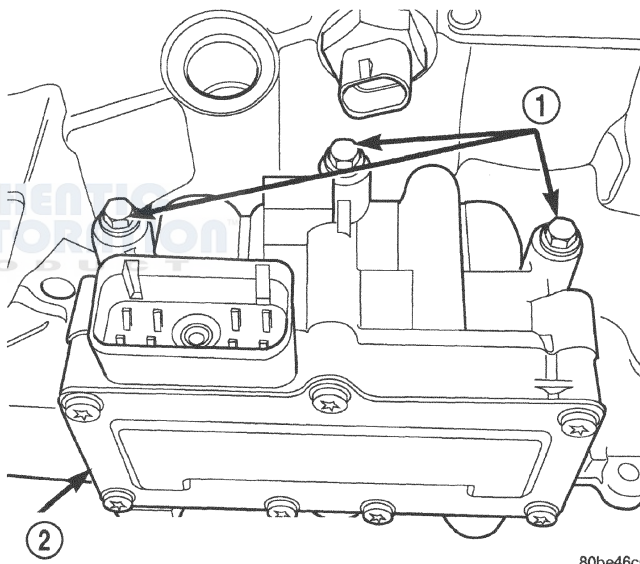
- 1 - TRANSMISSION CONTROL MODULE

(4) Disconnect and remove the input speed sensor (Fig. 65).

(5) Disconnect the transmission oil cooler lines. Cap off hoses and fittings to prevent foreign matter intrusion.

(6) Disconnect the solenoid/pressure switch assembly connector.

(7) Remove the three solenoid/pressure switch assembly-to-transaxle case bolts (Fig. 66).

**Fig. 66 Attaching Bolts**

- 1 - BOLTS  
2 - SOLENOID AND PRESSURE SWITCH ASSEMBLY

(8) Remove solenoid/pressure switch assembly and gasket (Fig. 67).

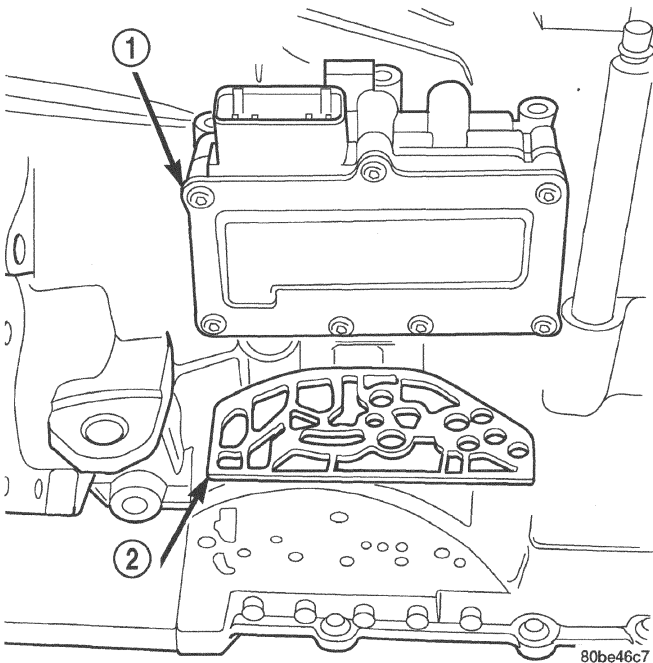
**CAUTION:** Be sure to keep foreign material from entering ports in transaxle case. Erratic transaxle operation and/or failure can result.

**INSTALLATION**

(1) Install solenoid/pressure switch assembly to case using a new gasket (Fig. 67).

(2) Install bolts and torque to 13 N·m (110 in. lbs.) (Fig. 66).



**REMOVAL AND INSTALLATION (Continued)**

**Fig. 67 Solenoid/Pressure Switch Assembly and Gasket**

- 1 - SOLENOID/PRESSURE SWITCH ASSEMBLY  
2 - GASKET

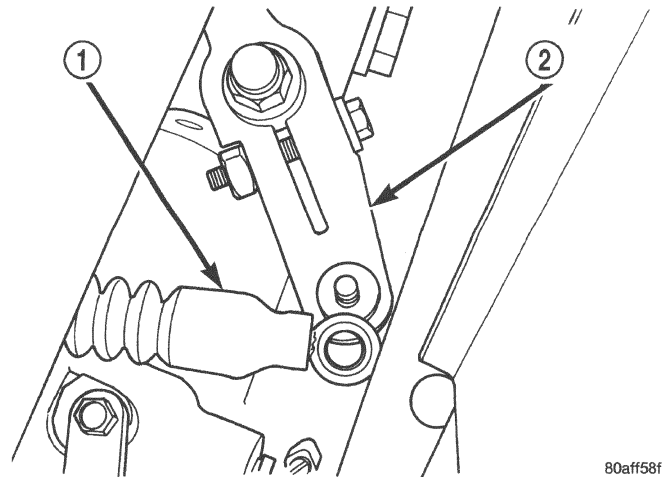
- (3) Install 8-way connector and torque screw to 4 N·m (35 in. lbs.).  
(4) Uncap and install transmission oil cooler lines.  
(5) Install input speed sensor (Fig. 65) and torque to 27 N·m (20 ft. lbs.).  
(6) Install Transmission Control Module (TCM) (Fig. 64).  
(7) Install air cleaner assembly.  
(8) Connect battery negative cable.  
(9) Perform Transaxle Quick Learn Procedure. Refer to Service Procedures.

**TRANSMISSION RANGE SENSOR**

The valve body assembly must be removed to gain access to and replace the transmission range sensor.

**REMOVAL**

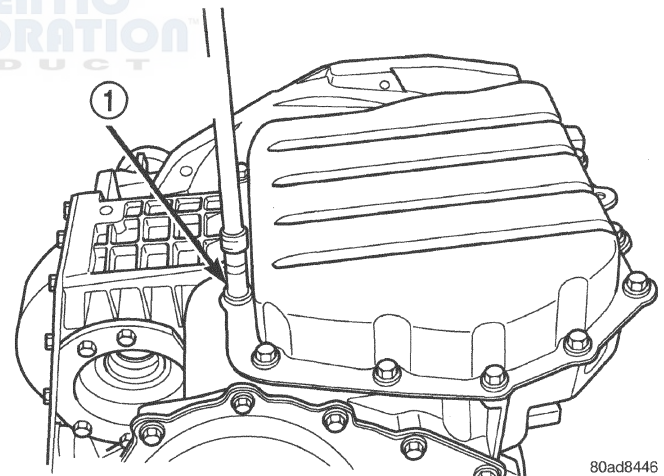
- (1) Disconnect battery negative cable.  
(2) Remove engine air cleaner assembly.  
(3) Disconnect gearshift cable from manual valve lever (Fig. 68).



**Fig. 68 Gearshift Cable at Lever**

- 1 - SHIFT CABLE  
2 - SHIFT LEVER

- (4) Remove manual valve lever.  
(5) Disconnect transmission range sensor connector.  
(6) Hoist vehicle.  
(7) Remove oil pan bolts (Fig. 69).



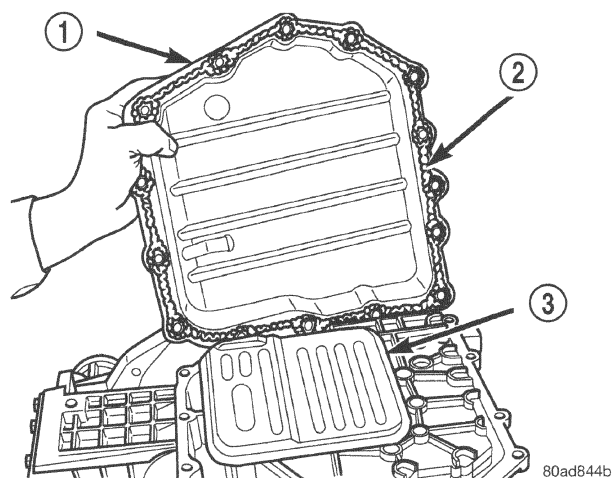
**Fig. 69 Oil Pan Bolts**

- 1 - OIL PAN BOLTS (USE RTV UNDER BOLT HEADS)

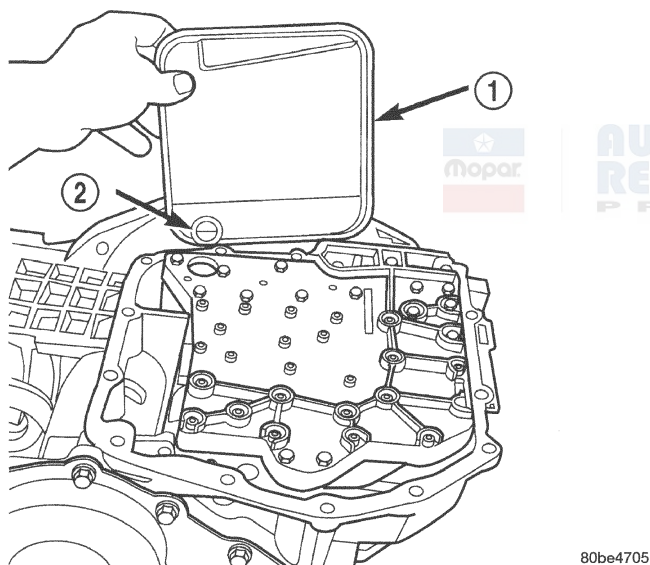
- (8) Remove oil pan (Fig. 70).  
(9) Remove oil filter (Fig. 71).



## REMOVAL AND INSTALLATION (Continued)

**Fig. 70 Oil Pan**

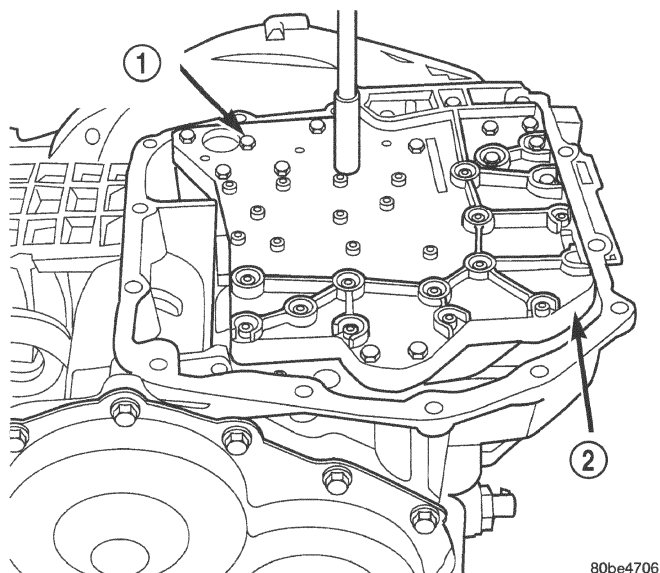
- 1 - OIL PAN
- 2 - 1/8 INCH BEAD OF RTV SEALANT
- 3 - OIL FILTER

**Fig. 71 Oil Filter**

- 1 - OIL FILTER
- 2 - O-RING

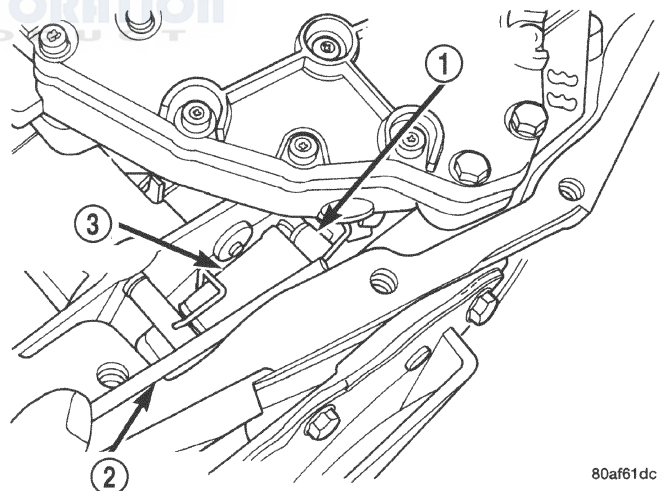
(10) Remove the valve body-to-transaxle case bolts (Fig. 72).

**NOTE:** To ease removal of the valve body, turn the manual valve lever fully clockwise to low or first gear.

**Fig. 72 Valve Body Attaching Bolts**

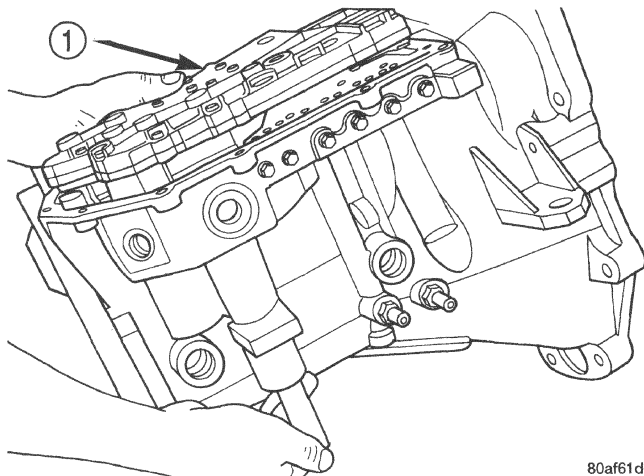
- 1 - VALVE BODY ATTACHING BOLTS (18)
- 2 - VALVE BODY

(11) Remove park rod rollers from guide bracket and remove valve body from transaxle (Fig. 73) (Fig. 74).

**Fig. 73 Push Park Rod Rollers from Guide Bracket**

- 1 - PARK SPRAG ROLLERS
- 2 - SCREWDRIVER
- 3 - PARK SPRAG GUIDE BRACKET

**CAUTION:** The valve body manual shaft pilot may distort and bind the manual valve if the valve body is mishandled or dropped.

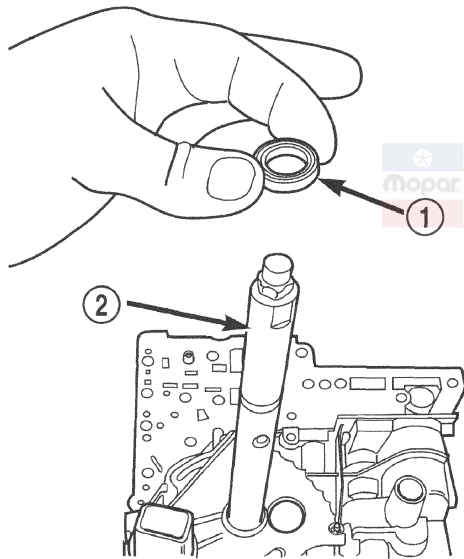
**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 74 Valve Body Removal/Installation**

1 - VALVE BODY

(12) Remove manual shaft seal (Fig. 75).

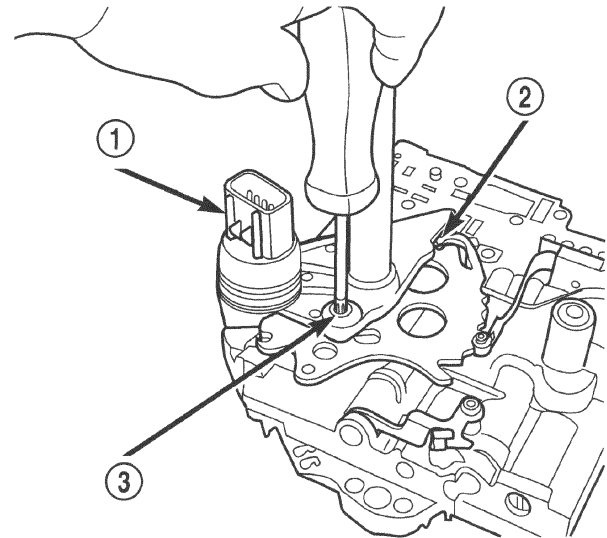


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**Fig. 75 Remove Manual Shaft Seal**

1 - SEAL

2 - MANUAL SHAFT



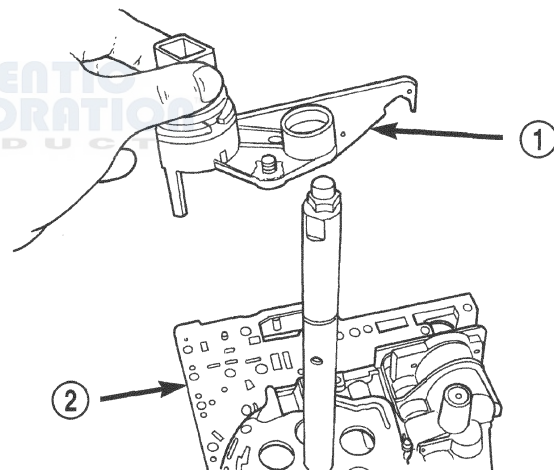
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**Fig. 76 Remove Retaining Screw**

1 - TRANSMISSION RANGE SENSOR

2 - MANUAL VALVE CONTROL PIN

3 - RETAINING SCREW



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**Fig. 77 Remove Transmission Range Sensor**

1 - TRANSMISSION RANGE SENSOR

2 - VALVE BODY

**INSTALLATION**

- (1) Install transmission range sensor (Fig. 77).
- (2) Tighten retaining screw (Fig. 76) to 5 N·m (45 in. lbs.).
- (3) Install manual shaft seal (Fig. 75).
- (4) Guide park rod rollers into guide bracket while installing valve body to the transaxle case (Fig. 73) (Fig. 74).

(5) Install the valve body-to-case bolts (Fig. 72) and torque to 12 N·m (105 in. lbs.).

(6) Install the oil filter (Fig. 71). Inspect the o-ring for damage and replace as necessary.

(7) Install an 1/8" bead of RTV as shown in (Fig. 70) and install pan to case.

(8) Install oil pan bolts (Fig. 69) and torque to 19 N·m (165 in. lbs.) torque.

(9) Lower vehicle.

(10) Connect transmission range sensor connector.

(11) Install manual valve lever to manual valve.

(12) Install gear shift cable to manual valve lever (Fig. 68).

**REMOVAL AND INSTALLATION (Continued)**

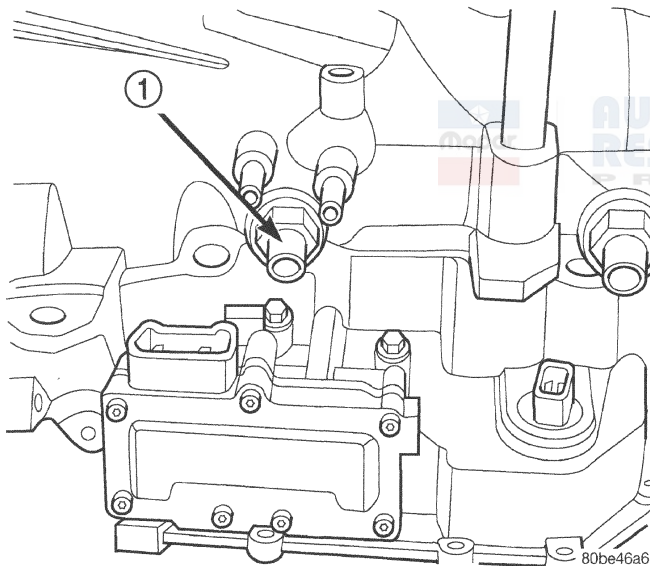
- (13) Install air cleaner assembly.
- (14) Connect battery negative cable.
- (15) Fill transaxle with ATF+4 (Automatic Transmission Fluid–Type 9602). Refer to Fluid Level and Condition in this Group.

**INPUT SPEED SENSOR**

**CAUTION:** When disconnecting speed sensor connector, be sure that the connector weather seal does not fall off or remain in old sensor.

**REMOVAL**

- (1) Disconnect battery negative cable.
- (2) If necessary, disconnect and cap off transmission oil cooler lines.
- (3) Disconnect input speed sensor connector.
- (4) Unscrew and remove input speed sensor (Fig. 78).
- (5) Inspect speed sensor o-ring (Fig. 79) and replace if necessary.

**Fig. 78 Input (Turbine) Speed Sensor**

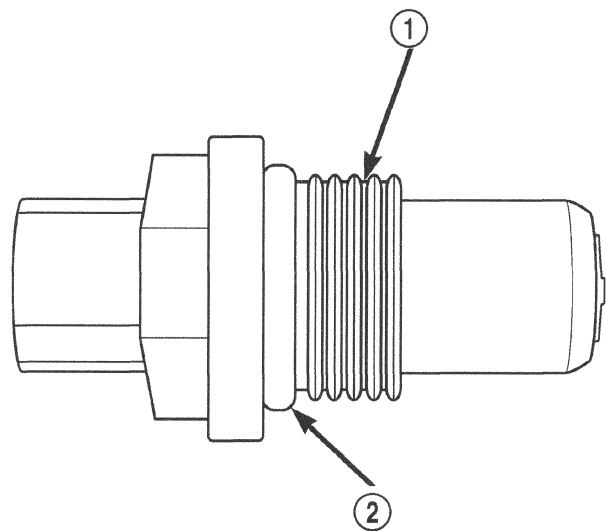
1 – INPUT SPEED SENSOR

**INSTALLATION**

- (1) Verify o-ring is installed into position.
- (2) Install and tighten input speed sensor to 27 N·m (20 ft. lbs.).
- (3) Connect speed sensor connector.
- (4) Connect battery negative cable.

**OUTPUT SPEED SENSOR**

**CAUTION:** When disconnecting speed sensor connector, be sure that the connector weather seal does not fall off or remain in old sensor.



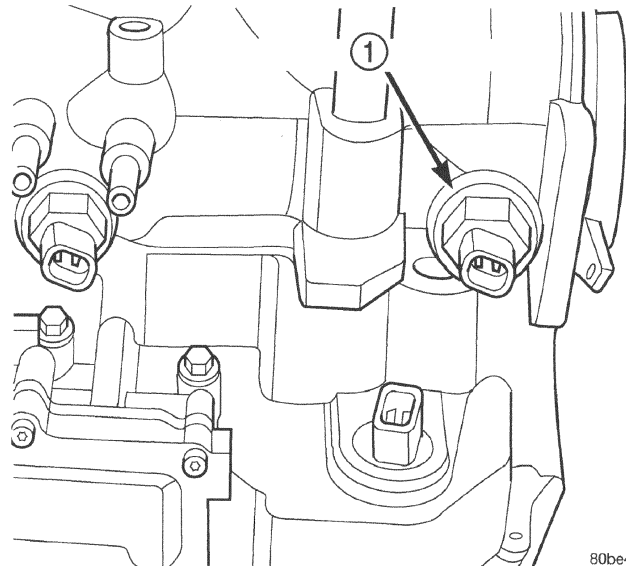
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**Fig. 79 O-ring Location**

- 1 – INPUT SPEED SENSOR
- 2 – O-RING

**REMOVAL**

- (1) Disconnect battery negative cable.
- (2) Disconnect input speed sensor connector.
- (3) Unscrew and remove output speed sensor (Fig. 80).
- (4) Inspect speed sensor o-ring (Fig. 81) and replace if necessary.



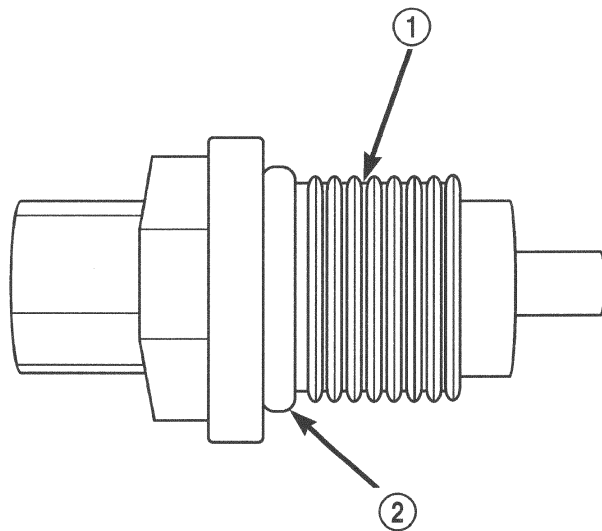
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**Fig. 80 Output Speed Sensor**

1 – OUTPUT SPEED SENSOR



## REMOVAL AND INSTALLATION (Continued)



80be46b9

**Fig. 81 O-ring Location**

- 1 - OUTPUT SPEED SENSOR  
2 - O-RING

## INSTALLATION

- (1) Verify o-ring is installed into position (Fig. 81).
- (2) Install and tighten input speed sensor to 27 N·m (20 ft. lbs.).
- (3) Connect speed sensor connector.
- (4) Connect battery negative cable.

## TRANSMISSION CONTROL MODULE

### REMOVAL

- (1) Disconnect battery negative cable at the left strut tower.
- (2) Remove TCM 60 way connector.
- (3) Remove three mounting screws.
- (4) Remove TCM.

### INSTALLATION

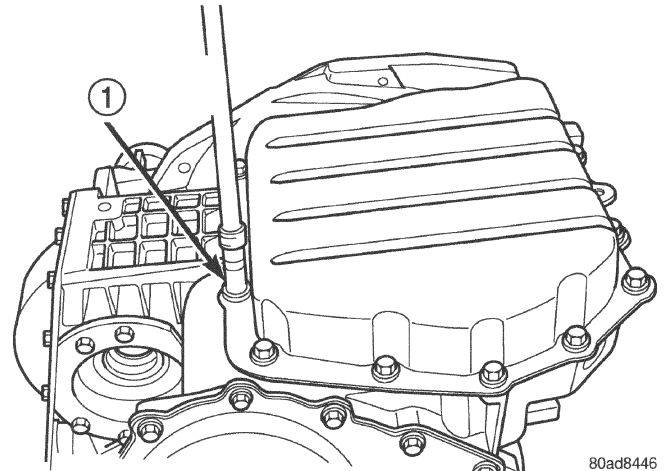
- (1) Install TCM and fasten with three mounting screws.
- (2) Connect the TCM 60 way connector and torque to 4 N·m (35 in. lbs.).
- (3) Connect the battery negative cable.

**NOTE:** After the Transmission Control Module has been replaced, the Transaxle Quick Learn & Pinion Factor procedures must be performed. Refer to Service Procedures.

## VALVE BODY

### REMOVAL

- (1) Remove oil pan bolts (Fig. 82).

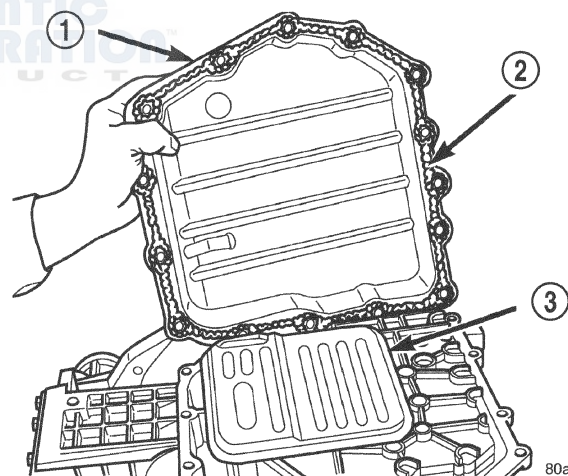


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**Fig. 82 Oil Pan Bolts**

- 1 - OIL PAN BOLTS (USE RTV UNDER BOLT HEADS)

- (2) Remove oil pan (Fig. 83).



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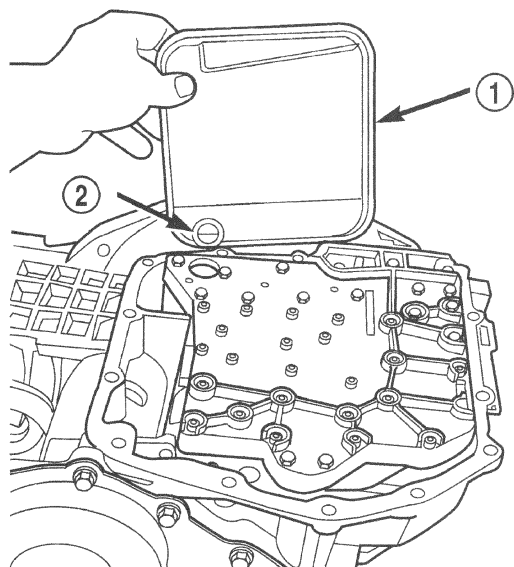
**Fig. 83 Oil Pan**

- 1 - OIL PAN  
2 - 1/8 INCH BEAD OF RTV SEALANT  
3 - OIL FILTER

- (3) Remove oil filter (Fig. 84).
- (4) Remove the valve body-to-transaxle case bolts (Fig. 85).

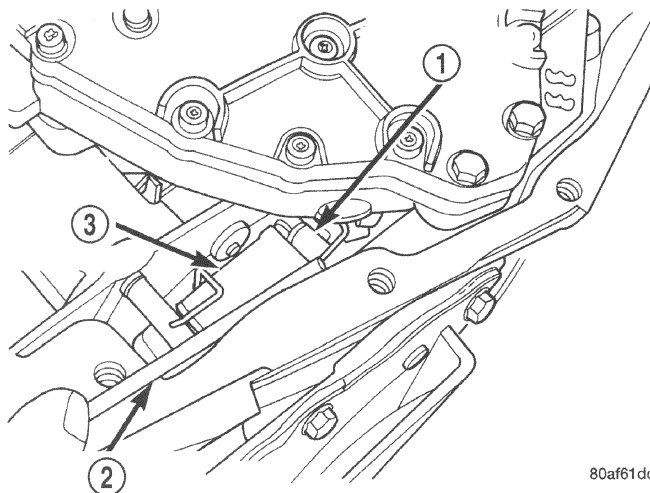
**NOTE:** To ease removal of the valve body, turn the manual valve lever fully clockwise to low or first gear.



**REMOVAL AND INSTALLATION (Continued)****Fig. 84 Oil Filter**

- 1 - OIL FILTER  
2 - O-RING

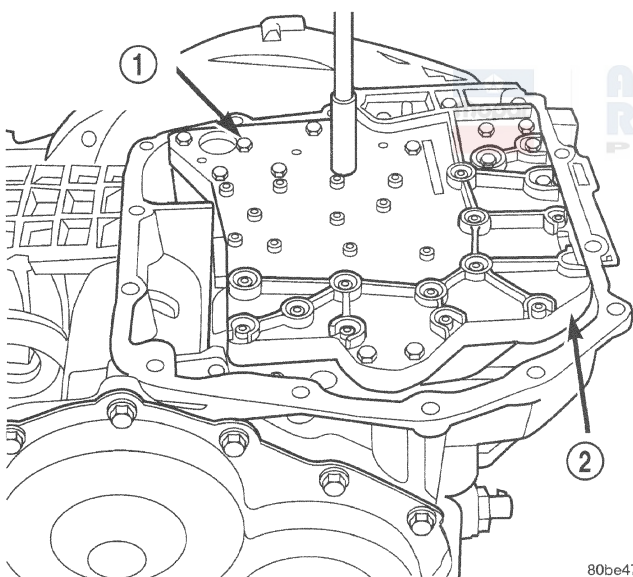
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**Fig. 86 Push Park Rod Rollers from Guide Bracket**

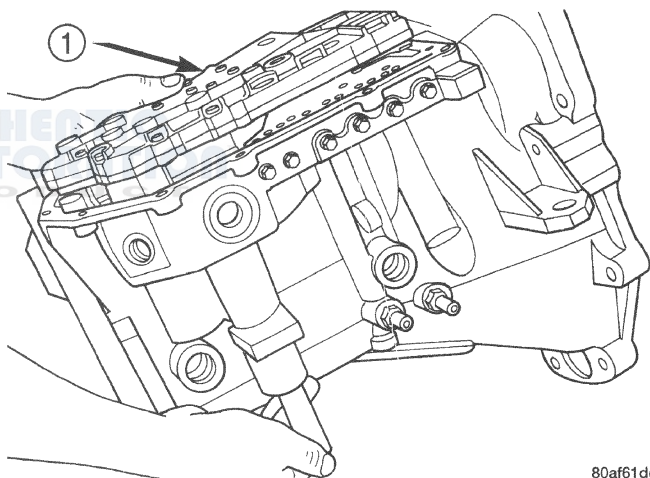
- 1 - PARK SPRAG ROLLERS  
2 - SCREWDRIVER  
3 - PARK SPRAG GUIDE BRACKET



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**Fig. 85 Valve Body Attaching Bolts**

- 1 - VALVE BODY ATTACHING BOLTS (18)  
2 - VALVE BODY



80af61de

**Fig. 87 Valve Body Removal/Installation**

- 1 - VALVE BODY

**INSTALLATION**

**NOTE:** To ease installation of the valve body, turn the manual valve lever fully clockwise.

(5) Remove park rod rollers from guide bracket and remove valve body from transaxle (Fig. 86) (Fig. 87).

**CAUTION:** The valve body manual shaft pilot may distort and bind the manual valve if the valve body is mishandled or dropped.

(1) Guide park rod rollers into guide bracket while installing valve body to the transaxle case (Fig. 86) (Fig. 87).

(2) Install the valve body-to-case bolts (Fig. 85) and torque to 12 N·m (105 in. lbs.).

(3) Install the oil filter (Fig. 84). Inspect the o-ring for damage and replace as necessary.

(4) Install an 1/8" bead of RTV as shown in (Fig. 83) and install pan to case.

## REMOVAL AND INSTALLATION (Continued)

(5) Install oil pan bolts (Fig. 82) and torque to 19 N·m (165 in. lbs.) torque.

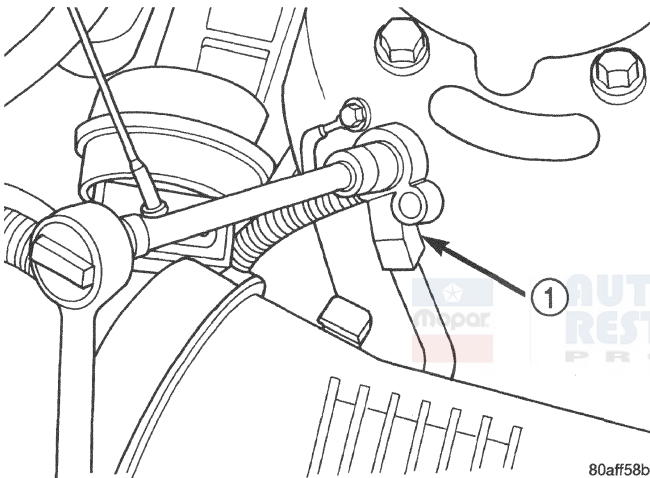
## TRANSAXLE

### REMOVAL

Transaxle removal does NOT require engine removal.

The transaxle and torque converter must be removed as an assembly; otherwise, the torque converter drive plate, pump bushing or oil seal may be damaged. The drive plate will not support a load; therefore, none of the weight of the transaxle should be allowed to rest on the drive plate during removal.

(1) Disconnect battery negative cable at left strut tower (Fig. 88).

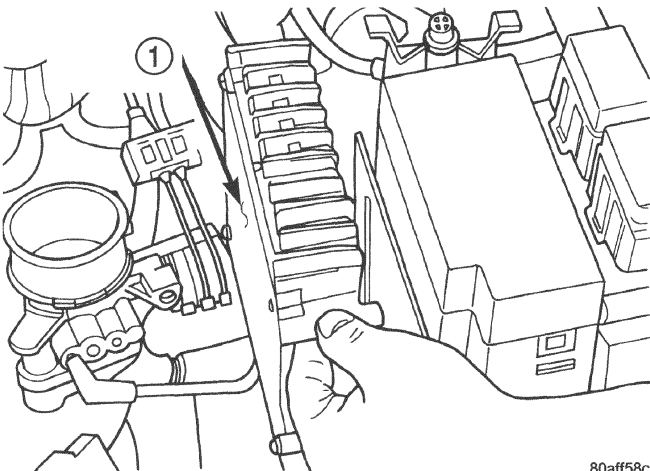


**Fig. 88 Negative Cable**

1 - NEGATIVE CABLE

(2) Remove air cleaner duct.

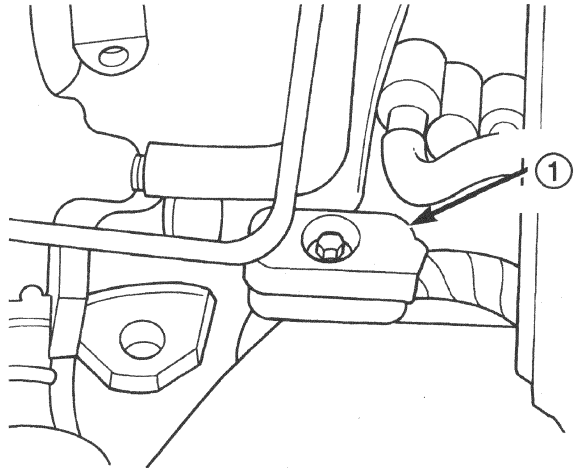
(3) Remove transmission control module (TCM) and wiring (Fig. 89).



**Fig. 89 Transmission Control Module**

1 - TRANSMISSION CONTROL MODULE

(4) Remove solenoid pack connector (Fig. 90).



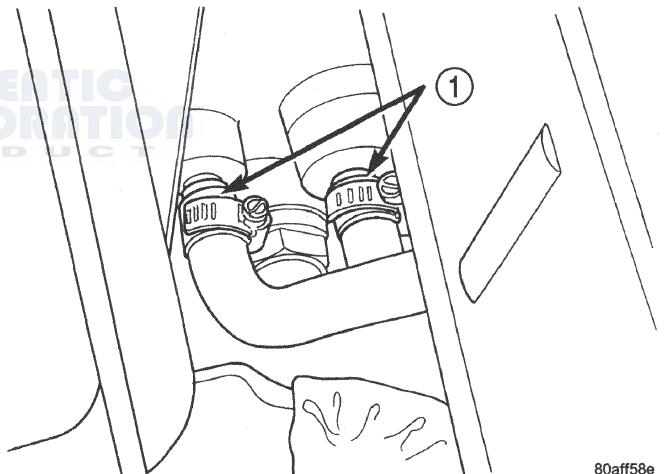
80aff58d

**Fig. 90 Solenoid Pack Connector**

1 - SOLENOID PACK CONNECTOR

(5) Remove dipstick tube.

(6) Remove transaxle cooler lines (Fig. 91).

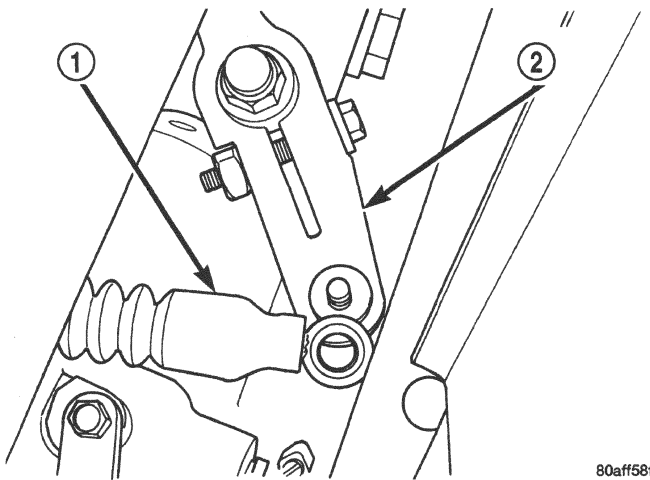


80aff58e

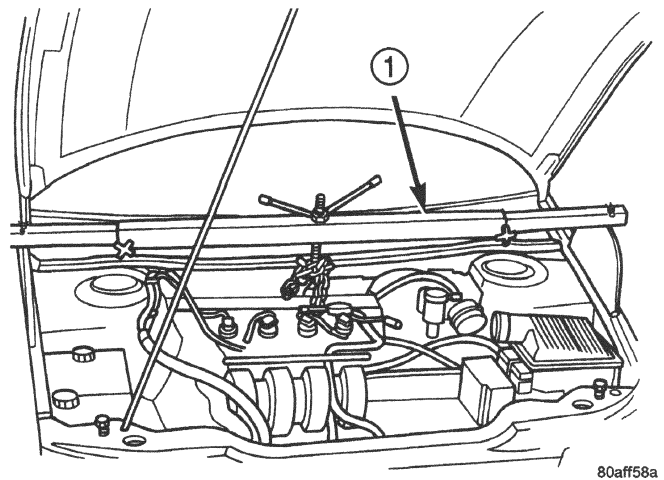
**Fig. 91 Transaxle Cooler Lines**

1 - TRANSAXLE COOLER LINES

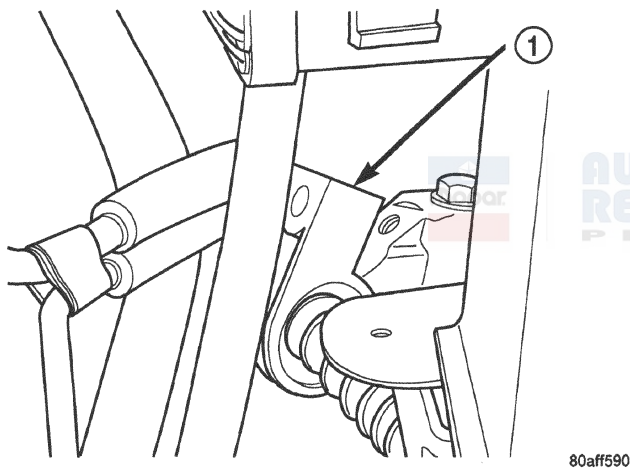
(7) Remove shift cable at lever and at clamp on transaxle (Fig. 92) (Fig. 93).

**REMOVAL AND INSTALLATION (Continued)****Fig. 92 Shift Cable at Lever**

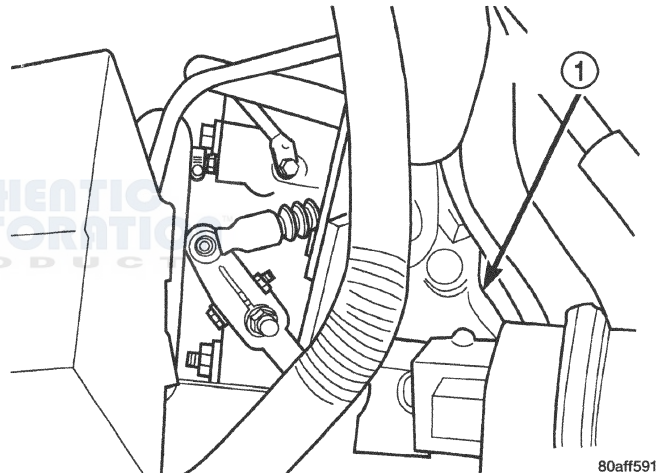
- 1 - SHIFT CABLE  
2 - SHIFT LEVER

**Fig. 94 Engine Support Fixture (Typical)**

- 1 - ENGINE BRIDGE FIXTURE

**Fig. 93 Shift Cable Clamp**

- 1 - SHIFT CABLE CLAMP

**Fig. 95 Upper Transaxle Mount**

- 1 - UPPER TRANSAXLE MOUNT

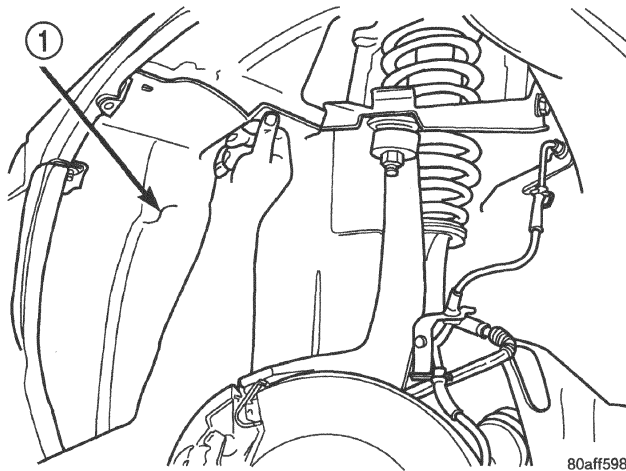
(8) Install engine support fixture and support engine (Fig. 94).

(9) Remove left upper transaxle mount top bolts (Fig. 95).

(10) Raise vehicle. Remove front wheels. Refer to Group 2, Suspension to remove wheel hub nuts and both drive shafts.

(11) Remove left and right side lower splash shields (Fig. 96).



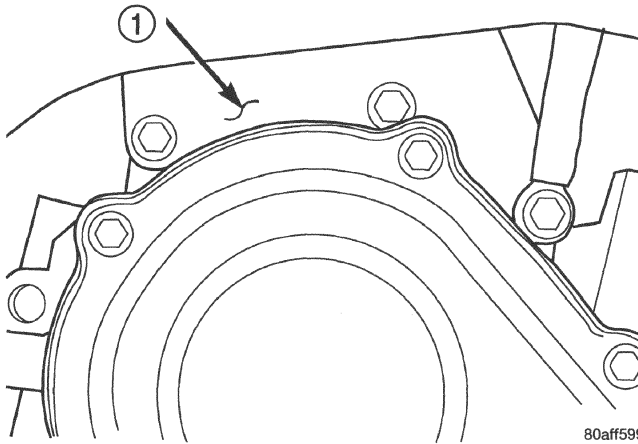
**REMOVAL AND INSTALLATION (Continued)****Fig. 96 Lower Splash Shields**

1 - SPLASH SHIELD

**CAUTION:** The exhaust flex joint must be disconnected from the exhaust manifold anytime the engine is lowered. If the engine is lowered while the flex pipe is attached, damage will occur.

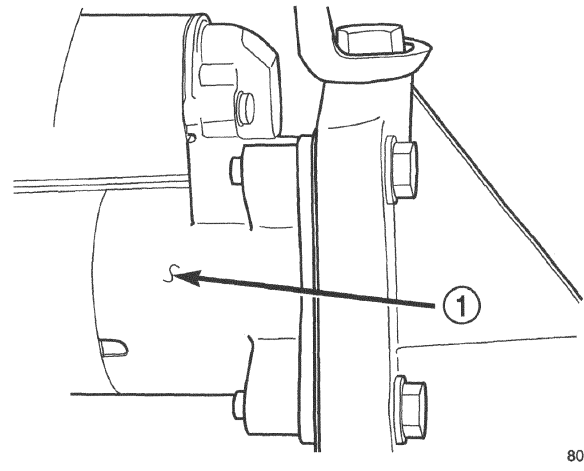
(12) Remove bolts securing exhaust flex joint to exhaust manifold. Disconnect exhaust pipe from manifold.

(13) Remove remaining left upper mount bolts (Fig. 97).

**Fig. 97 Left Mount Bolts**

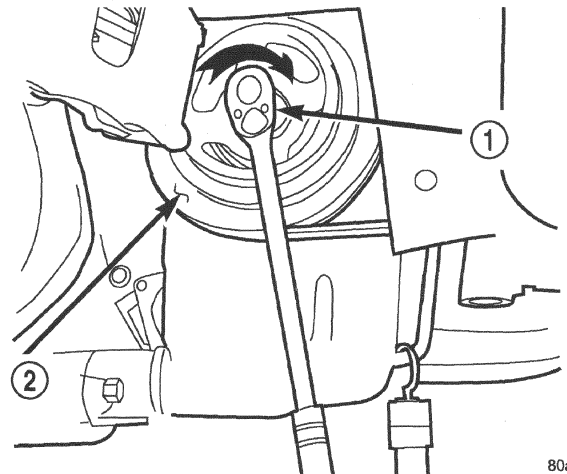
1 - UPPER TRANSAXLE MOUNT

- (14) Remove engine oil filter.
- (15) Remove starter and wiring (Fig. 98).
- (16) Remove front motor mount bracket.

**Fig. 98 Starter**

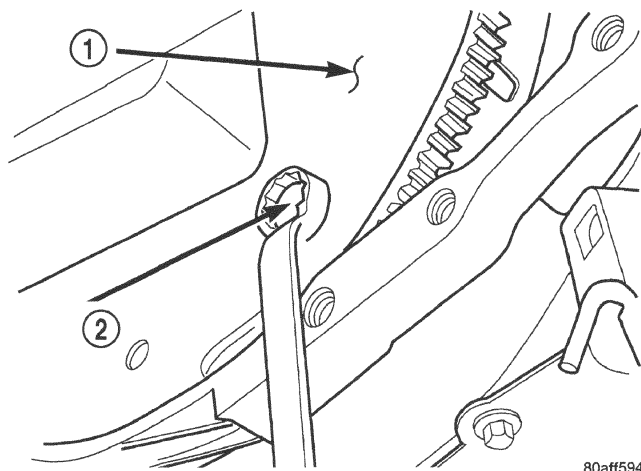
1 - STARTER

- (17) Remove rear mount bracket through-bolt.
- (18) Remove center member bolts.
- (19) Remove rear mount bracket bolts, and remove rear mount bracket.
- (20) Remove radiator lower crossmember.
- (21) Remove lateral bending strut brackets (front and rear).
- (22) Remove flex plate cover.
- (23) Rotate engine clockwise to line up converter bolts (Fig. 99). Remove converter bolts (Fig. 100). Mark converter for reassembly ease.

**Fig. 99 Rotate Engine Clockwise**

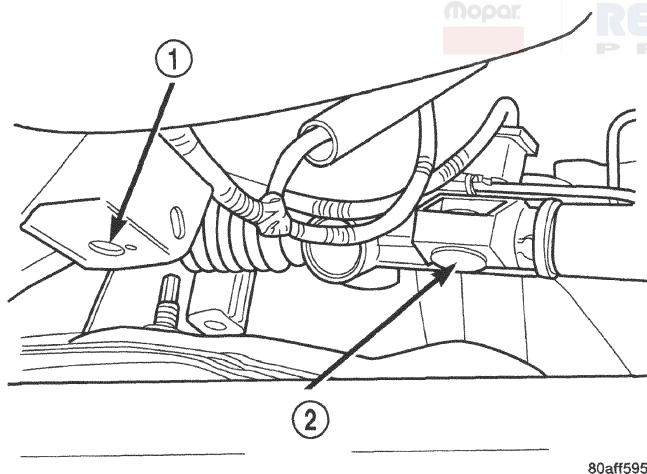
- 1 - TURN CLOCKWISE
- 2 - LOWER ENGINE PULLEY



**REMOVAL AND INSTALLATION (Continued)****Fig. 100 Converter Bolts**

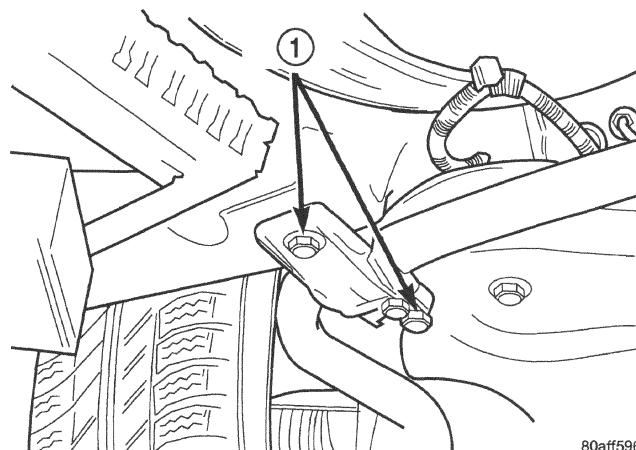
- 1 - DRIVE PLATE  
2 - DRIVE PLATE BOLT

- (24) Remove crank position sensor (if equipped).  
(25) Remove transaxle wiring.  
(26) Loosen right side steering gear bolts. Loosen right side K-frame bolts.  
(27) Remove left side steering gear bolts. Remove left side K-frame bolts (Fig. 101).

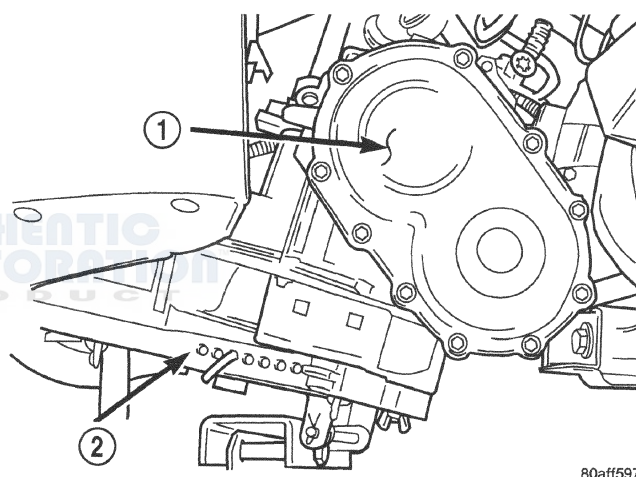
**Fig. 101 Steering Gear and K-frame Bolts**

- 1 - K-FRAME MOUNT  
2 - STEERING RACK MOUNT

- (28) Remove sway bar mounts (Fig. 102).  
(29) Position transmission jack under transaxle and support with safety chain (Fig. 103).  
(30) Remove upper and lower transaxle bell housing bolts.  
(31) Move K-frame rearward and carefully lower the transaxle assembly from vehicle.

**Fig. 102 Sway Bar Mounts**

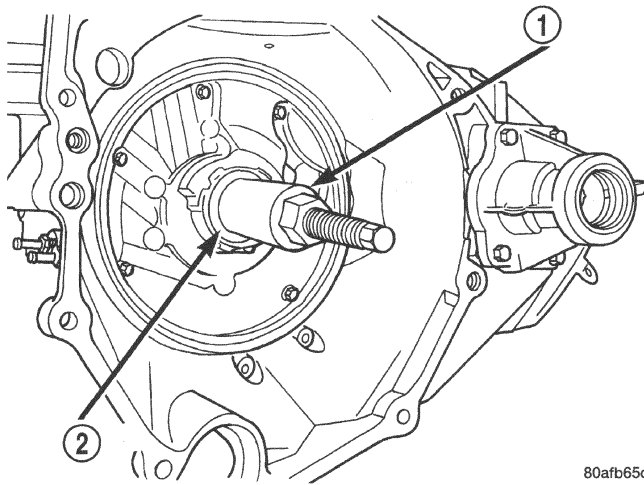
- 1 - SWAY BAR MOUNT

**Fig. 103 Transmission Jack**

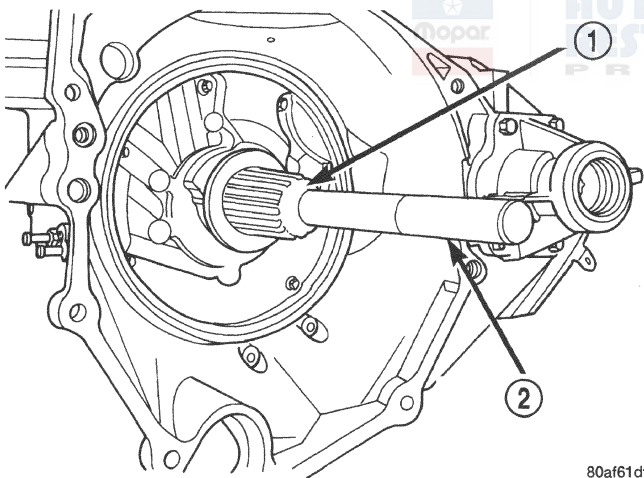
- 1 - TRANSAXLE  
2 - TRANSMISSION JACK

**INSTALLATION**

- (1) For installation of transaxle, reverse the above procedure.  
(2) Check and/or adjust gear shift cable.  
(3) Refill transaxle with Mopar® ATF+4 (Automatic Transmission Fluid-Type 9602)

**REMOVAL AND INSTALLATION (Continued)****OIL PUMP SEAL****REMOVAL****Fig. 104 Remove Oil Pump Seal**

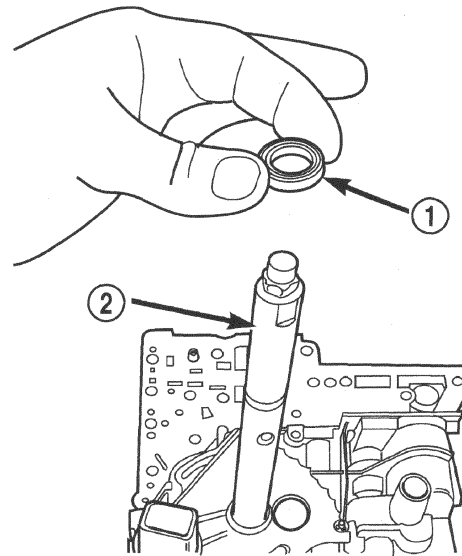
- 1 - TOOL C-3981-B  
2 - OIL PUMP SEAL

**INSTALLATION****Fig. 105 Install Oil Pump Seal**

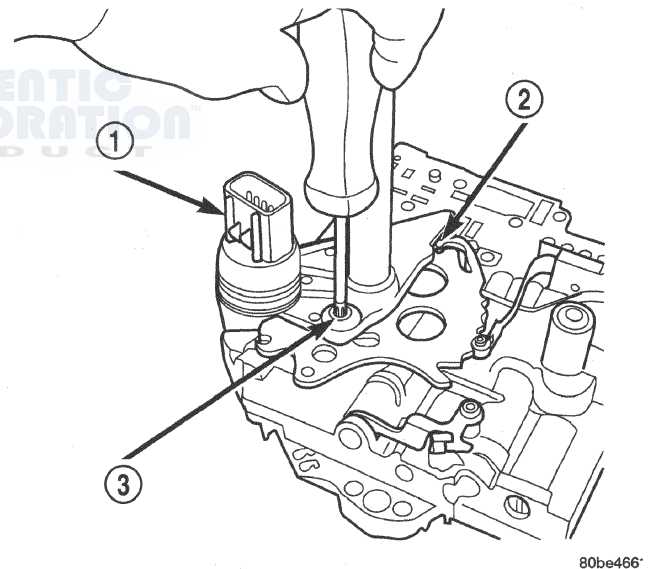
- 1 - TOOL C-4193  
2 - HANDLE TOOL C-4171

**DISASSEMBLY AND ASSEMBLY****VALVE BODY****DISASSEMBLY**

- (1) Remove manual shaft seal (Fig. 106).
- (2) Remove Transmission Range Sensor retaining screw (Fig. 107).

**Fig. 106 Manual Shaft Seal**

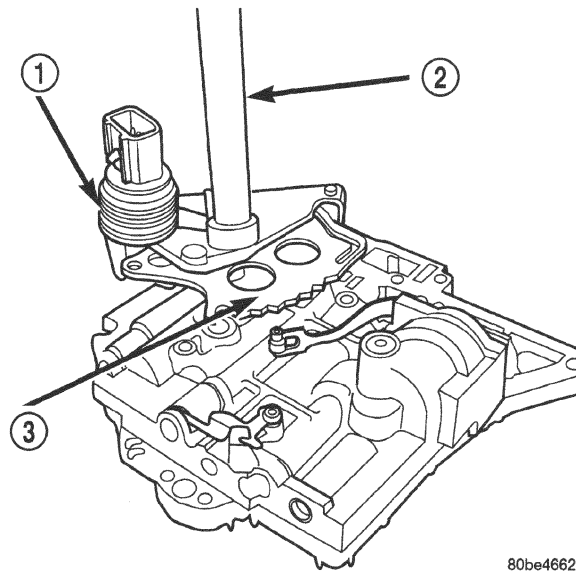
- 1 - SEAL  
2 - MANUAL SHAFT

**Fig. 107 Remove Transmission Range Sensor Retaining Screw**

- 1 - TRANSMISSION RANGE SENSOR  
2 - MANUAL VALVE CONTROL PIN  
3 - RETAINING SCREW

(3) Remove Manual Shaft/Rooster Comb and Transmission Range Sensor (Fig. 108).

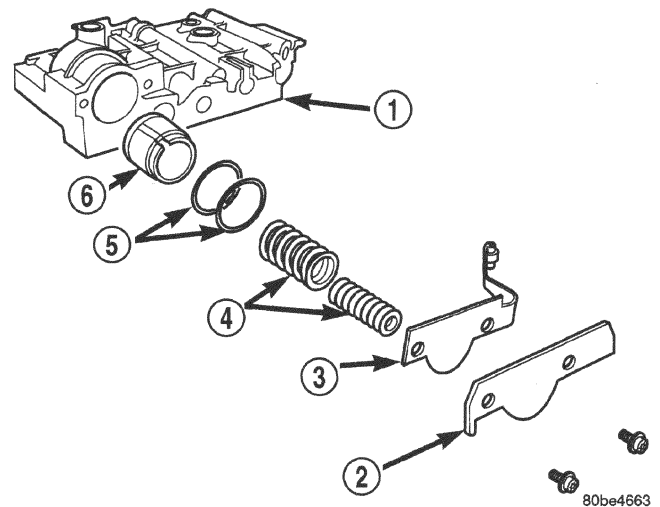
(4) Remove 2/4 Accumulator Retaining Plate (Fig. 109).

**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 108 Manual Shaft/Rooster Comb and Transmission Range Sensor**

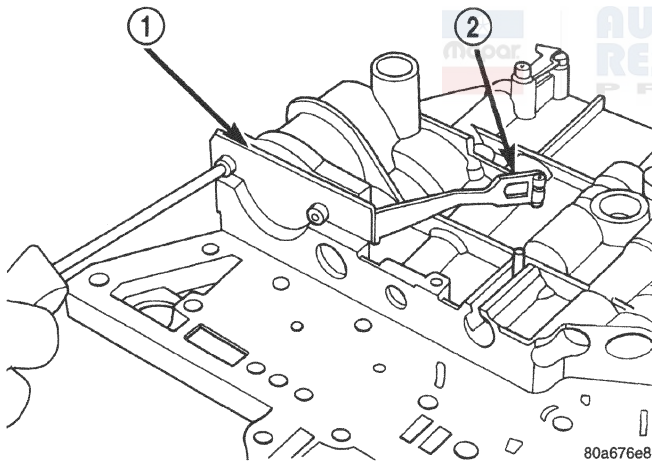
- 1 - TRANSMISSION RANGE SENSOR
- 2 - MANUAL SHAFT
- 3 - ROOSTER COMB



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**Fig. 110 2/4 Accumulator Assembly**

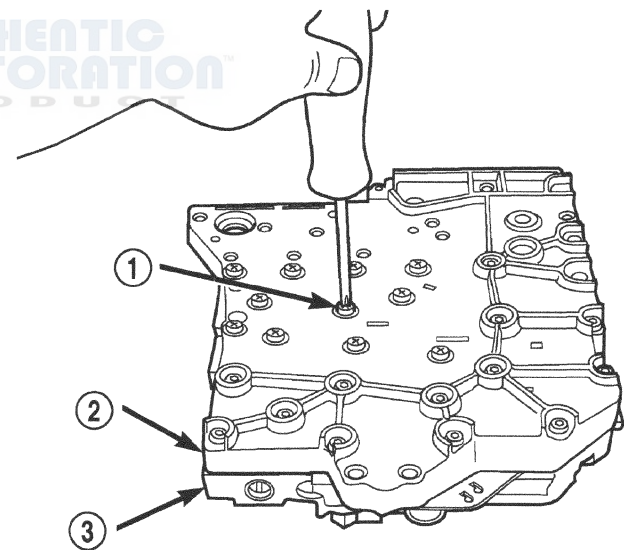
- 1 - VALVE BODY
- 2 - RETAINER PLATE
- 3 - DETENT SPRING
- 4 - SPRINGS
- 5 - SEALS
- 6 - PISTON



80a676e8

**Fig. 109 2/4 Accumulator Retaining Plate**

- 1 - 2-4 ACCUMULATOR RETAINING PLATE
- 2 - DETENT SPRING



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**Fig. 111 Remove Valve Body to Transfer Plate Screws**

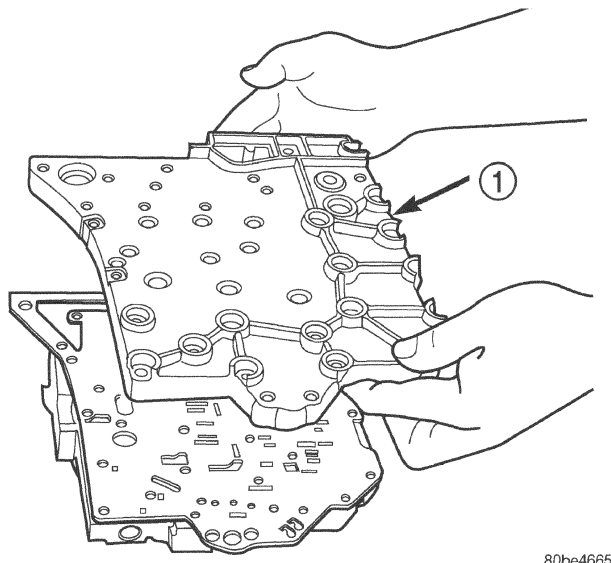
- 1 - SCREW (24)
- 2 - TRANSFER PLATE
- 3 - VALVE BODY

(5) Remove 2/4 Accumulator components as shown in (Fig. 110).

(6) Remove Valve Body to Transfer Plate screws (Fig. 111).

**DISASSEMBLY AND ASSEMBLY (Continued)**

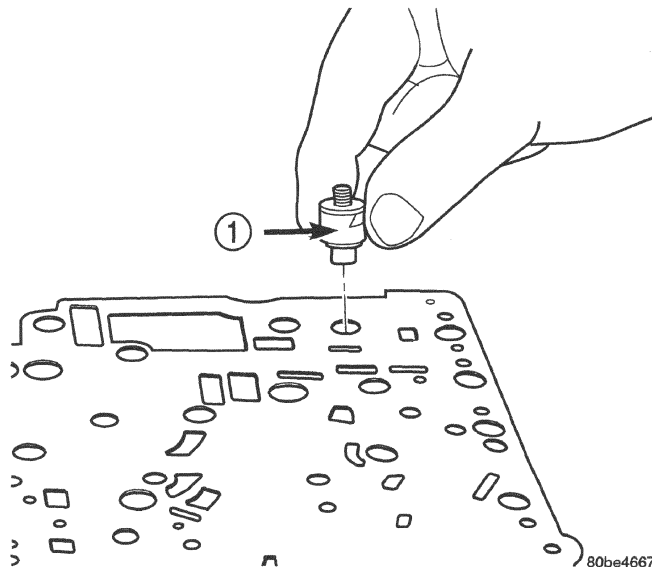
(7) Invert assembly and remove Transfer Plate. Beware of loose check balls.



**Fig. 112 Remove Transfer Plate**

1 - TRANSFER PLATE

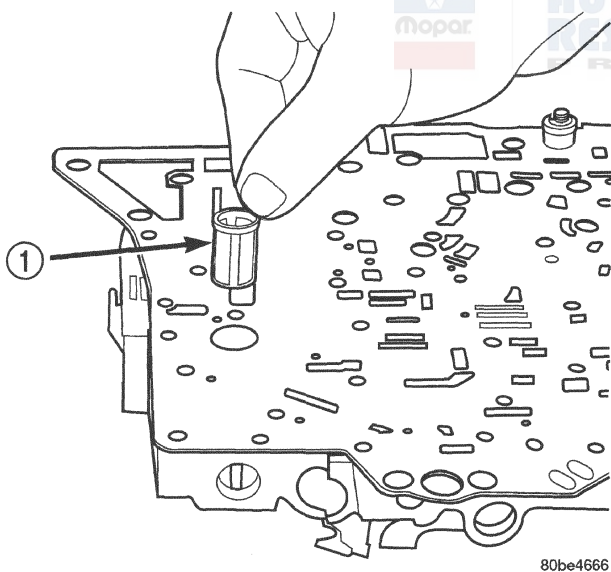
(9) Remove the overdrive clutch (#5) check valve (Fig. 114).



**Fig. 114 Remove Overdrive Clutch (#5) Check Valve**

1 - OVERDRIVE CLUTCH (#5) CHECK VALVE

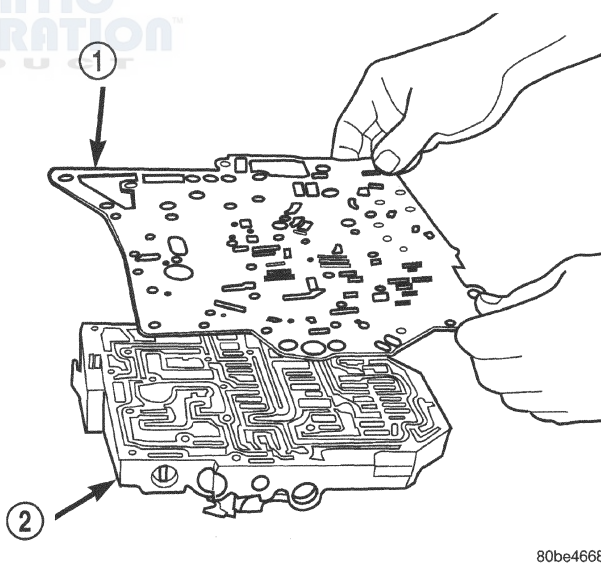
(8) Remove oil screen (Fig. 113).



**Fig. 113 Remove Oil Screen**

1 - OIL SCREEN

(10) Remove separator plate (Fig. 115).



**Fig. 115 Remove Separator Plate**

1 - SEPARATOR PLATE

2 - VALVE BODY



DISASSEMBLY AND ASSEMBLY (Continued)

(11) Remove thermal valve (Fig. 116).

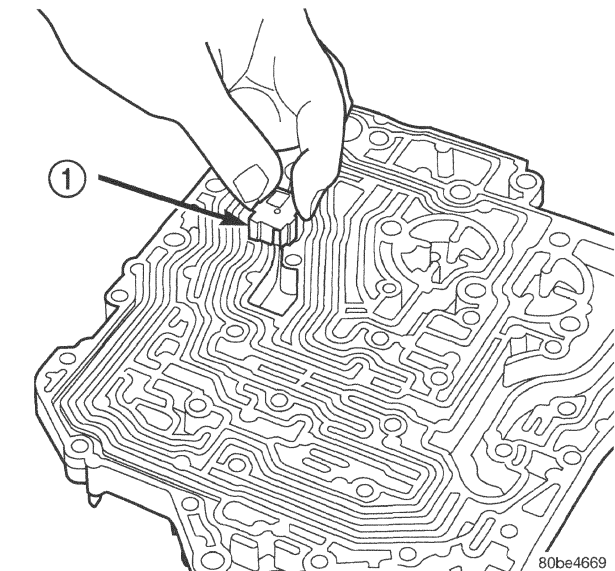


Fig. 116 Remove Thermal Valve

1 - THERMAL VALVE

(12) Remove check balls (Fig. 117).

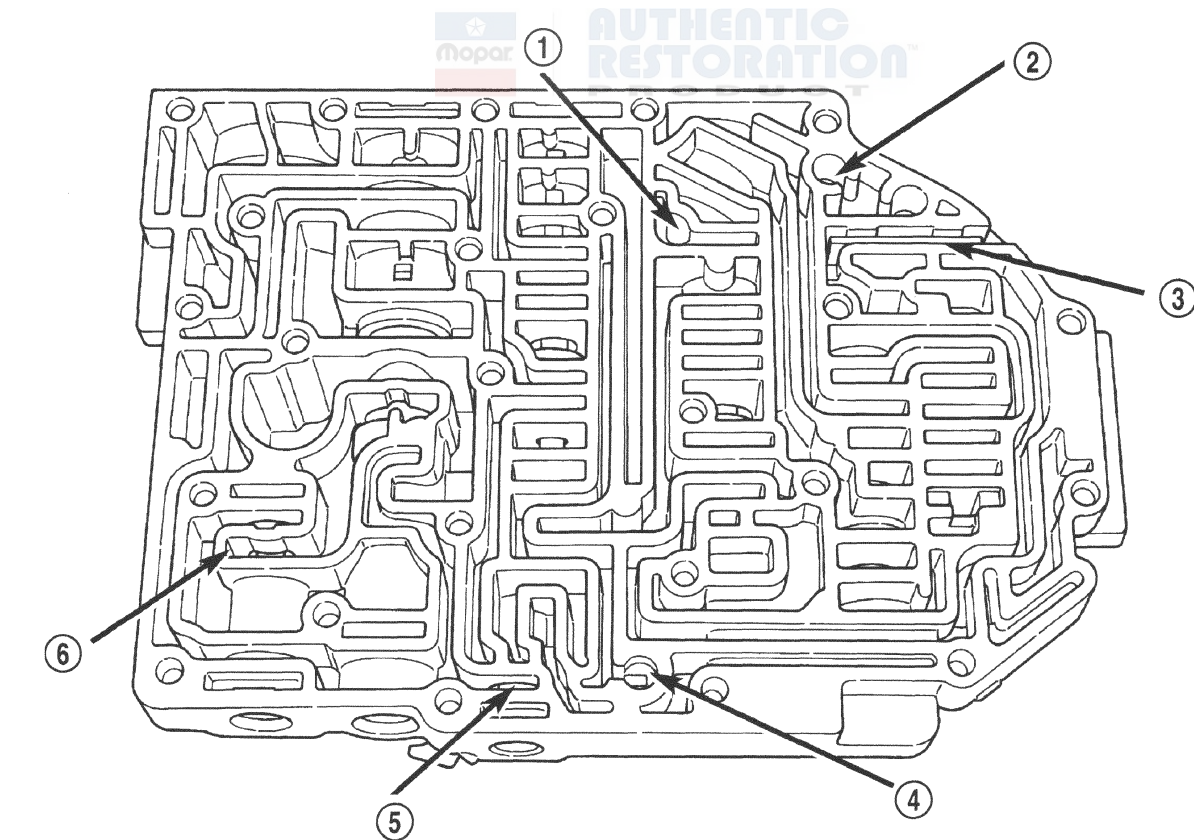


Fig. 117 Ball Check Location

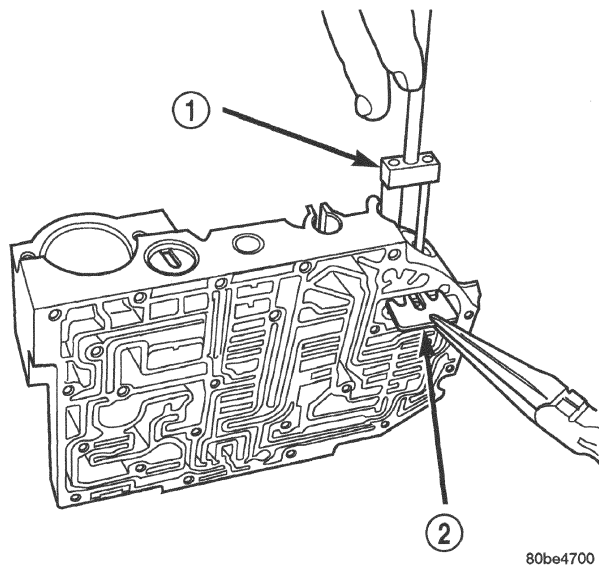
- |                              |                              |
|------------------------------|------------------------------|
| 1 - (#4) BALL CHECK LOCATION | 4 - (#3) BALL CHECK LOCATION |
| 2 - (#2) BALL CHECK LOCATION | 5 - LOW/REVERSE SWITCH VALVE |
| 3 - RETAINER                 | 6 - T/C LIMIT VALVE          |

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**DISASSEMBLY AND ASSEMBLY (Continued)**

**NOTE:** Tag all valve/spring assemblies for reassembly identification.

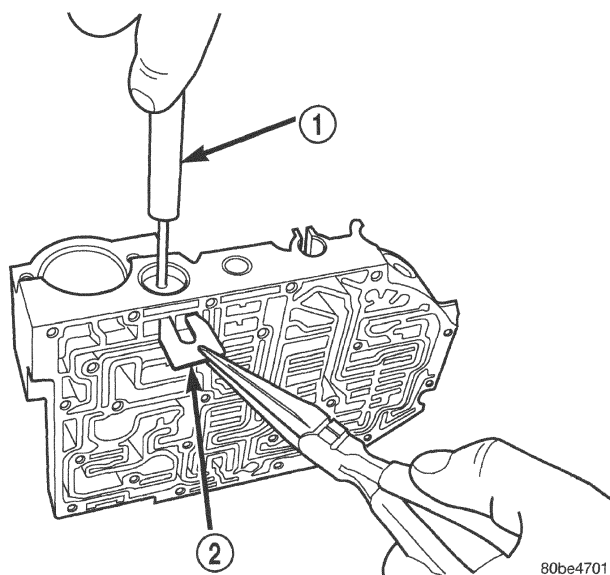
(13) Remove dual retainer plate using Tool 6301 (Fig. 118).



**Fig. 118 Remove Dual Retainer Plate using Tool 6301**

- 1 - TOOL 6301  
2 - RETAINER

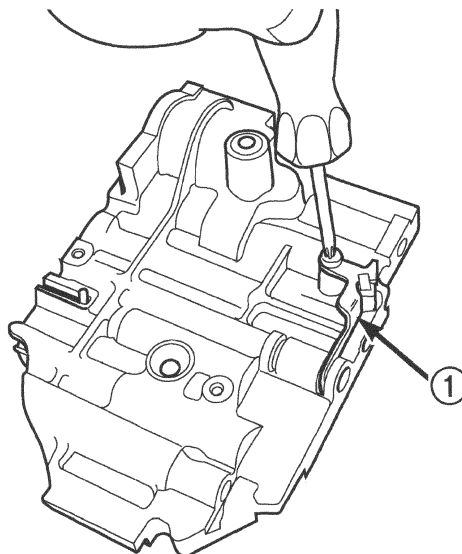
(14) Remove regulator valve spring retainer (Fig. 119).



**Fig. 119 Remove Regulator Valve Spring Retainer using Tool 6302**

- 1 - TOOL 6302  
2 - RETAINER

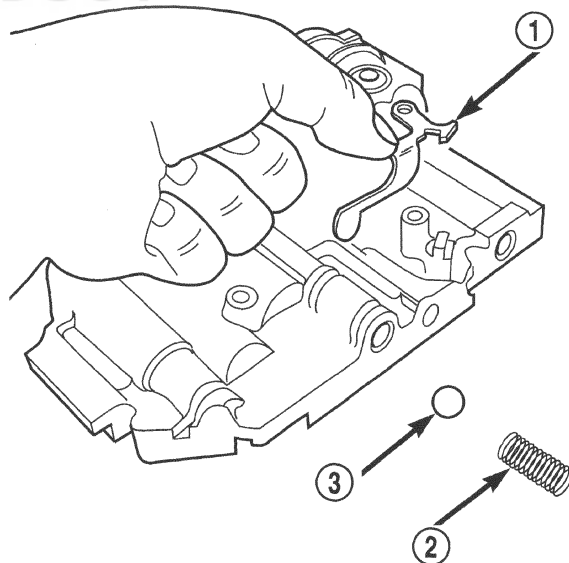
(15) Remove the vent reservoir check valve retainer (Fig. 120).



**Fig. 120 Remove Vent Reservoir Check Valve Retainer**

- 1 - RETAINER

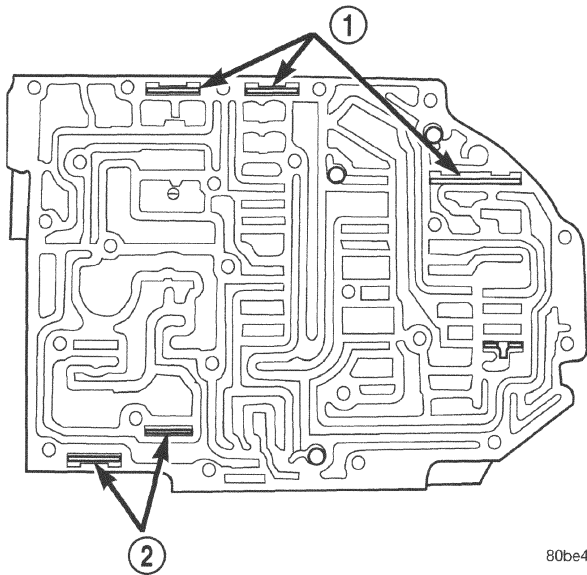
(16) Remove vent reservoir check valve and spring (Fig. 121).



**Fig. 121 Vent Reservoir Check Valve and Spring**

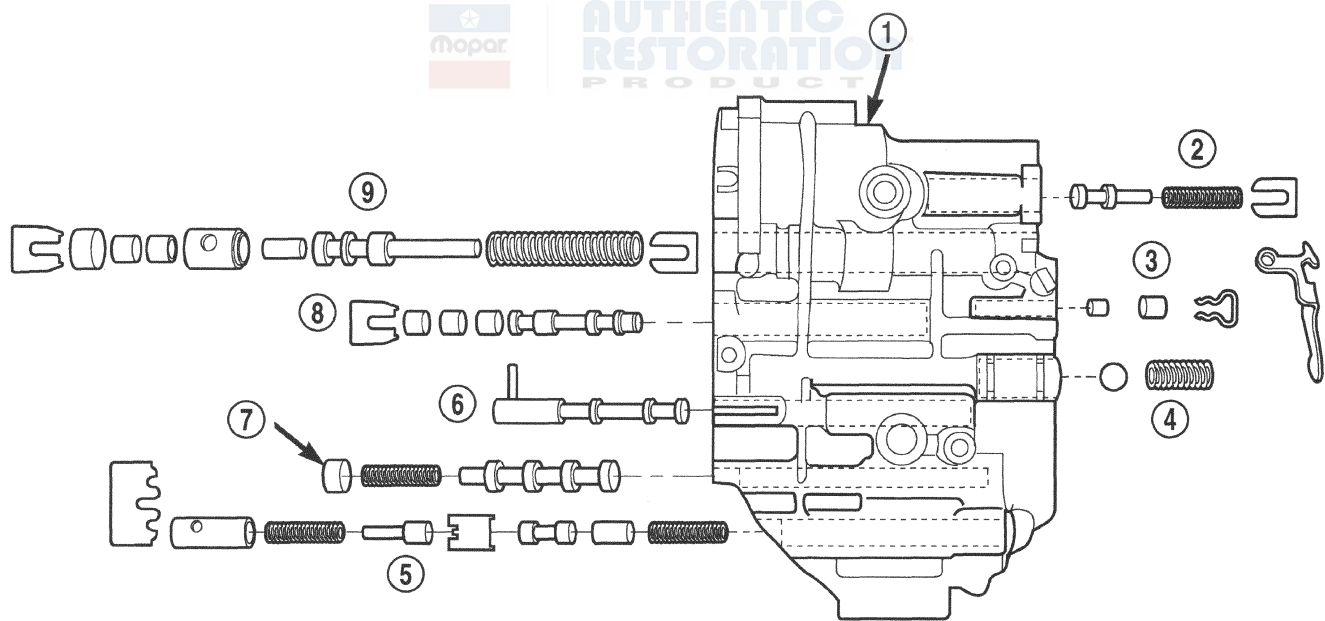
- 1 - RETAINER  
2 - SPRING  
3 - BALL

(17) Remove remaining retainers as shown in (Fig. 122).

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 122 Valve Retainer Location**

- 1 - RETAINER  
2 - RETAINER

(18) Remove valves and springs as shown in (Fig. 123).

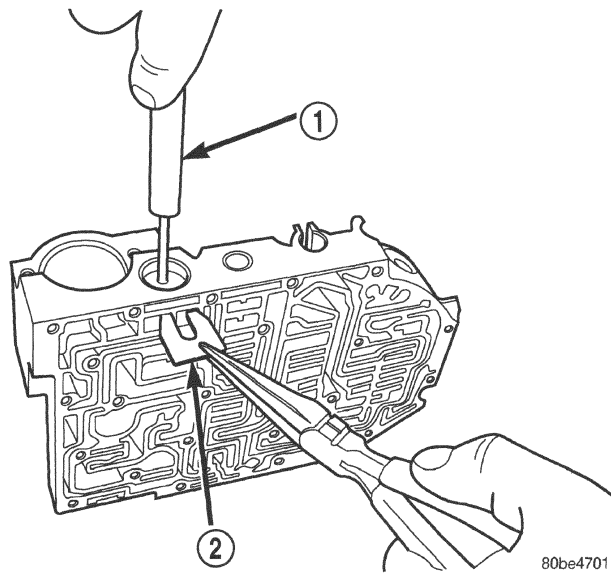
**Fig. 123 Springs and Valves Location**

- |                                    |                                   |
|------------------------------------|-----------------------------------|
| 1 - VALVE BODY                     | 6 - MANUAL VALVE                  |
| 2 - T/C REGULATOR VALVE            | 7 - CONVERTER CLUTCH SWITCH VALVE |
| 3 - L/R SWITCH VALVE               | 8 - SOLENOID SWITCH VALVE         |
| 4 - VENT RESERVOIR CHECK VALVE     | 9 - REGULATOR VALVE               |
| 5 - CONVERTER CLUTCH CONTROL VALVE |                                   |

**NOTE:** Refer to Valve Body Cleaning and Inspection for cleaning procedures.

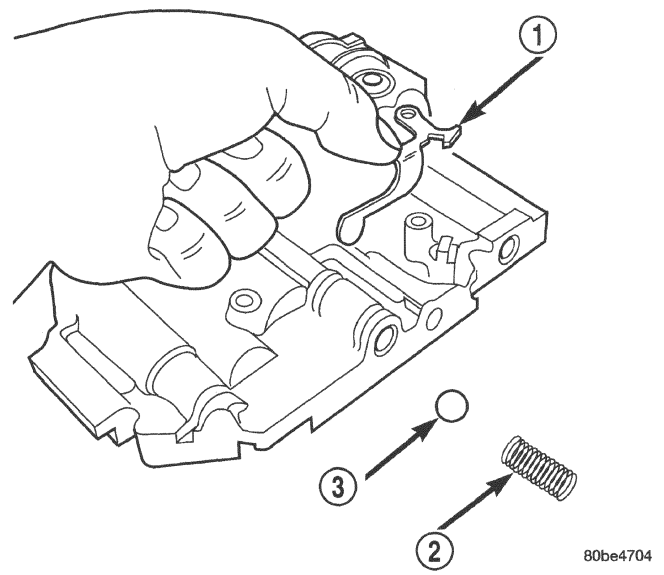
**ASSEMBLY**

- (1) Install valves and springs as shown in (Fig. 123).
- (2) Install regulator valve spring retainer (Fig. 124).
- (3) Install dual retainer plate using Tool 6301 (Fig. 125).
- (4) Install vent reservoir check valve and spring (Fig. 126).
- (5) Install the vent reservoir check valve retainer (Fig. 127).

**DISASSEMBLY AND ASSEMBLY (Continued)**

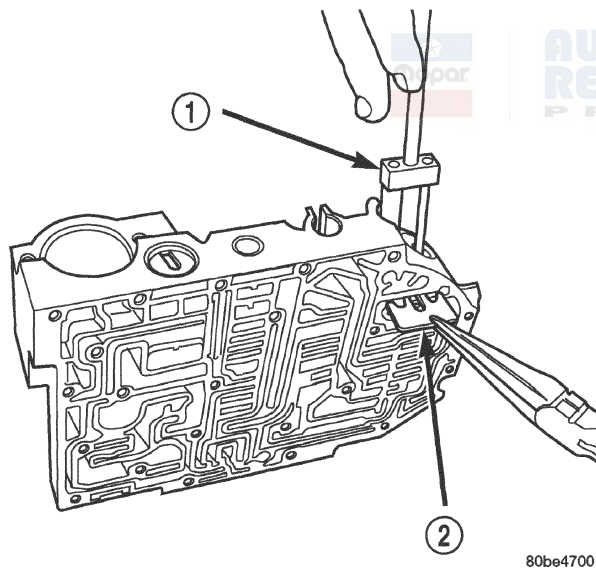
**Fig. 124 Install Regulator Valve Spring Retainer using Tool 6302**

- 1 - TOOL 6302  
2 - RETAINER



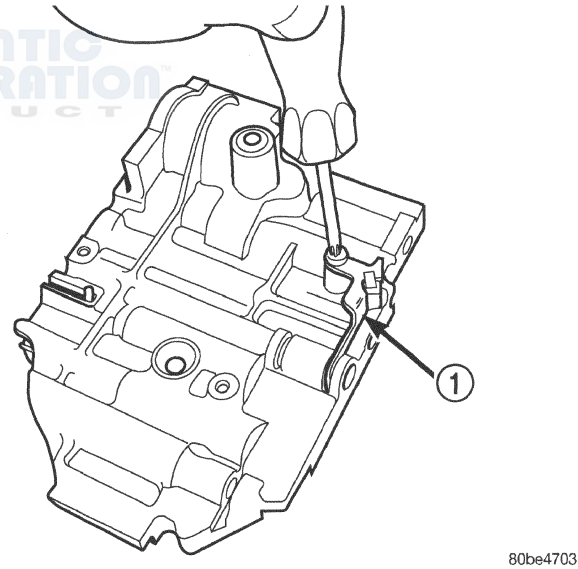
**Fig. 126 Vent Reservoir Check Valve and Spring**

- 1 - RETAINER  
2 - SPRING  
3 - BALL



**Fig. 125 Install Dual Retainer Plate using Tool 6301**

- 1 - TOOL 6301  
2 - RETAINER



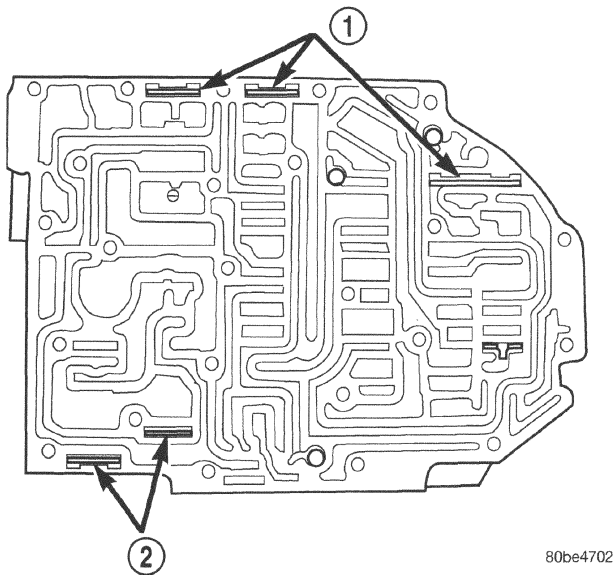
**Fig. 127 Install Vent Reservoir Check Valve Retainer**

- 1 - RETAINER

(6) Verify that all retainers are installed as shown in (Fig. 128). Retainers should be flush or below valve body surface.

(7) Install check balls into position as shown in (Fig. 129). If necessary, secure them with petrolatum or transmission assembly gel for assembly ease.

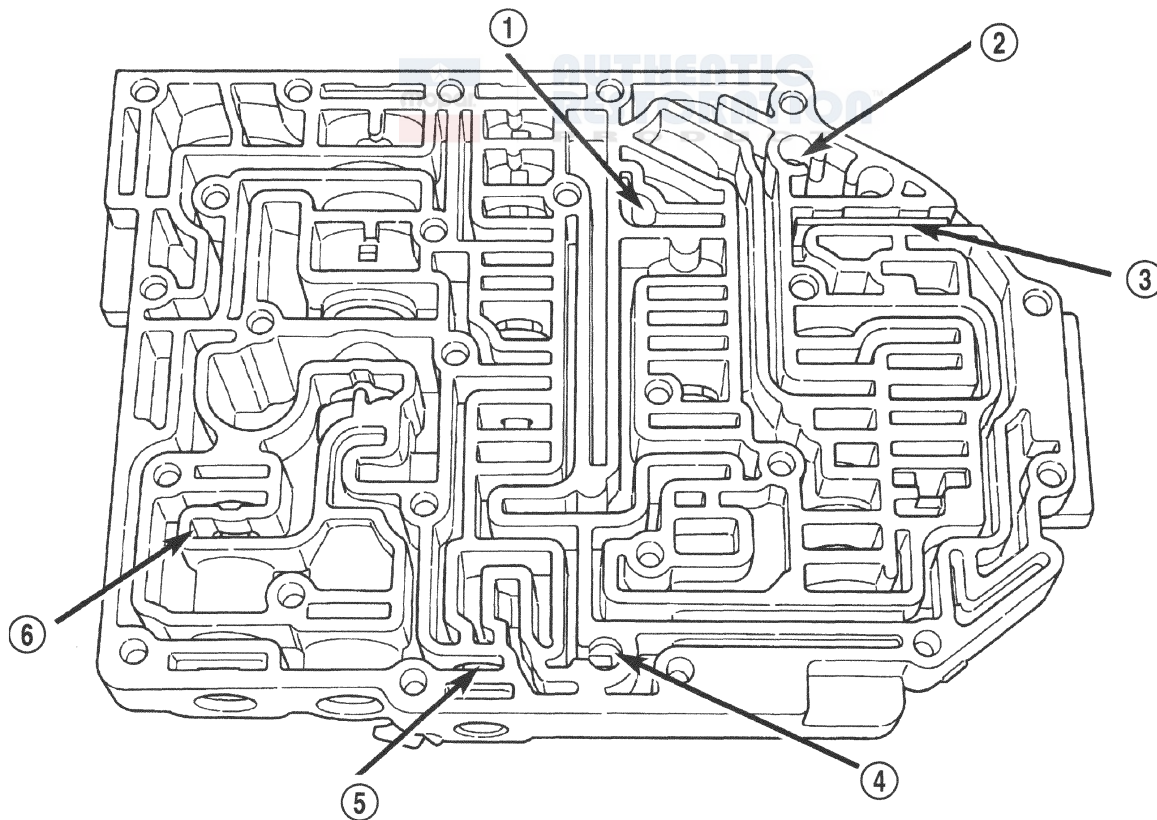


**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 128 Valve Retainer Location**

- 1 - RETAINER
- 2 - RETAINER



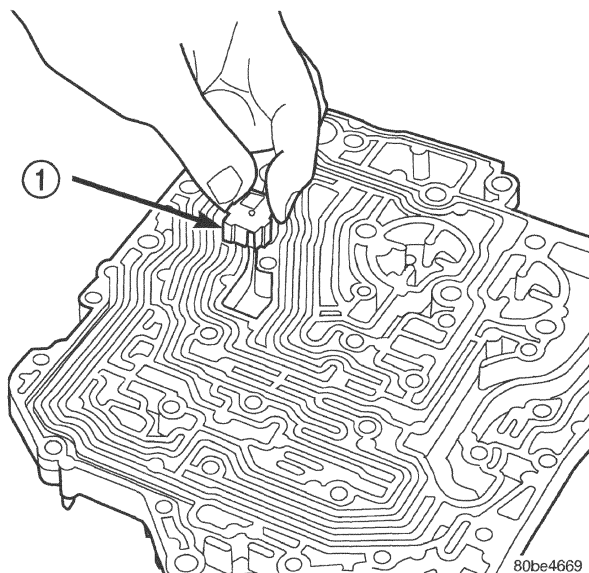
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**Fig. 129 Ball Check Location**

- |                              |                              |
|------------------------------|------------------------------|
| 1 - (#4) BALL CHECK LOCATION | 4 - (#3) BALL CHECK LOCATION |
| 2 - (#2) BALL CHECK LOCATION | 5 - LOW/REVERSE SWITCH VALVE |
| 3 - RETAINER                 | 6 - T/C LIMIT VALVE          |

**DISASSEMBLY AND ASSEMBLY (Continued)**

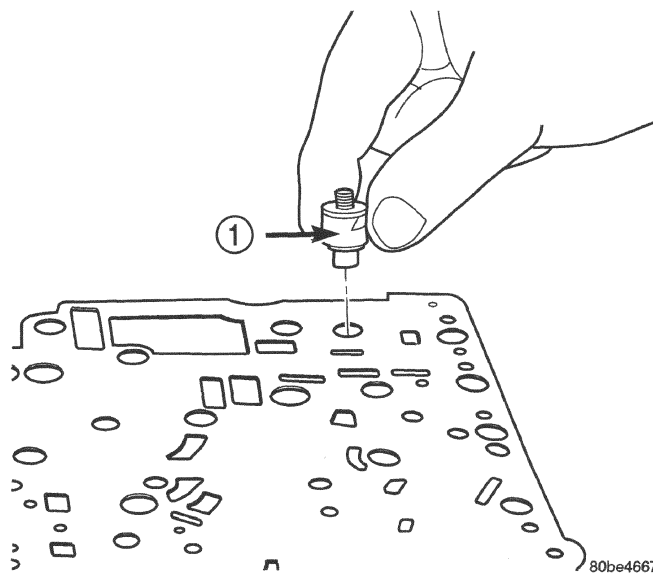
(8) Install thermal valve into transfer plate (Fig. 130).



**Fig. 130 Install Thermal Valve**

1 - THERMAL VALVE

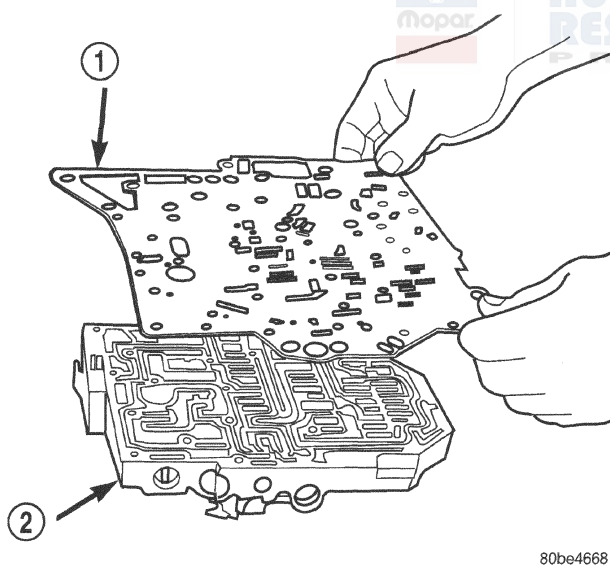
(10) Install the overdrive clutch (#5) check valve to separator plate (Fig. 132)



**Fig. 132 Install Overdrive Clutch (#5) Check Valve**

1 - OVERDRIVE CLUTCH (#5) CHECK VALVE

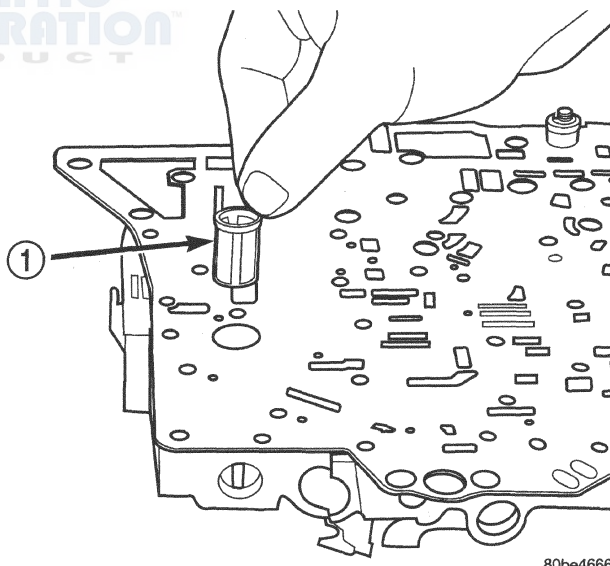
(9) Install separator plate to valve body (Fig. 131).



**Fig. 131 Install Separator Plate**

1 - SEPARATOR PLATE  
2 - VALVE BODY

(11) Install oil screen to separator plate (Fig. 133).

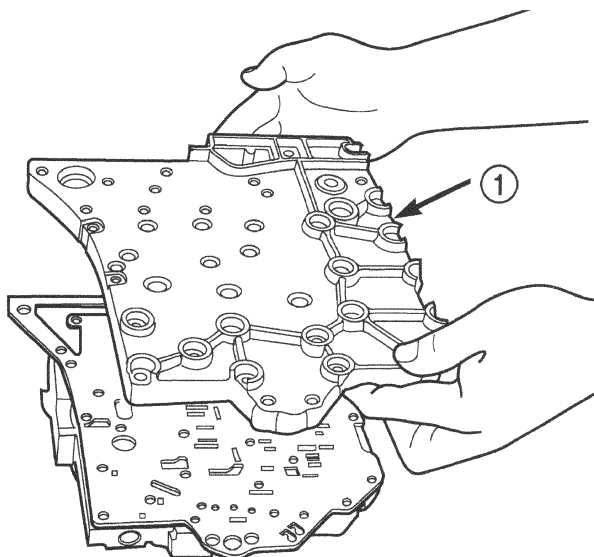


**Fig. 133 Install Oil Screen**

1 - OIL SCREEN

**DISASSEMBLY AND ASSEMBLY (Continued)**

(12) Install transfer plate to valve body and separator plate. Make sure oil screen and #5 check valve do not bind (Fig. 134).

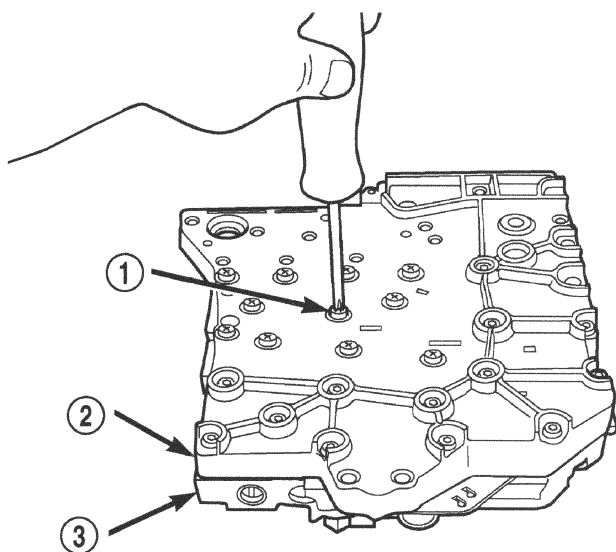


80be4665

**Fig. 134 Install Transfer Plate**

1 - TRANSFER PLATE

(13) Install twenty-four transfer plate to valve body screws (Fig. 135) and torque to 5 N·m (45 in. lbs.).

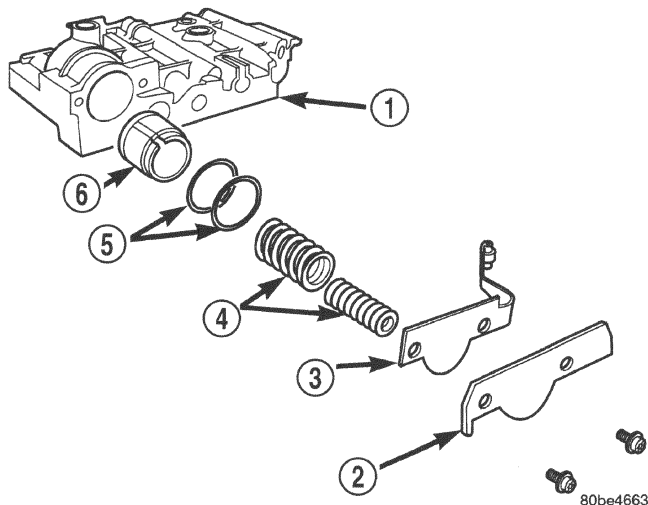


80be4664

**Fig. 135 Install Valve Body to Transfer Plate Screws**

1 - SCREW (24)  
2 - TRANSFER PLATE  
3 - VALVE BODY

(14) Install 2/4 Accumulator components as shown in (Fig. 136).

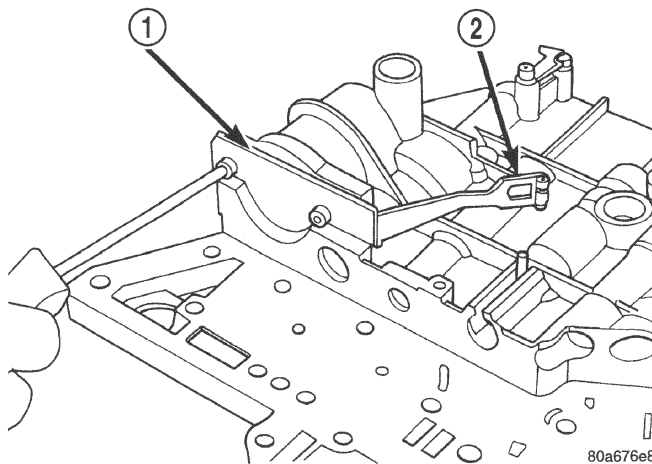


80be4663

**Fig. 136 2/4 Accumulator Assembly**

1 - VALVE BODY  
2 - RETAINER PLATE  
3 - DETENT SPRING  
4 - SPRINGS  
5 - SEALS  
6 - PISTON

(15) Torque 2/4 Accumulator retainer to 5 N·m (45 in. lbs.) (Fig. 137).

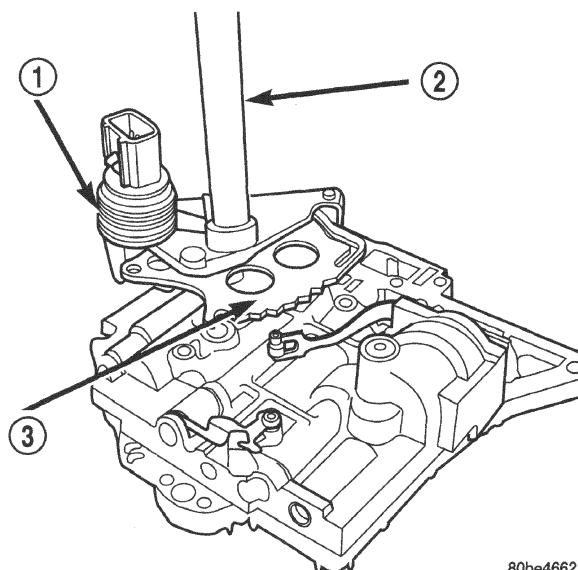


80a676e8

**Fig. 137 2/4 Accumulator Retaining Plate**

1 - 2-4 ACCUMULATOR RETAINING PLATE  
2 - DETENT SPRING

(16) Install Manual Shaft/Rooster Comb and Transmission Range Sensor (Fig. 138).

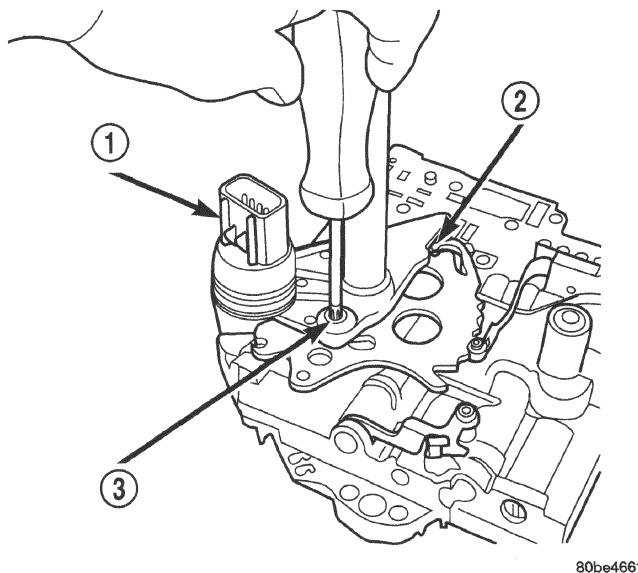
**DISASSEMBLY AND ASSEMBLY (Continued)**

80be4662

**Fig. 138 Install Manual Shaft/Rooster Comb and Transmission Range Sensor**

- 1 - TRANSMISSION RANGE SENSOR
- 2 - MANUAL SHAFT
- 3 - ROOSTER COMB

(17) Make sure Manual Valve control pin is contained within the rooster comb slot (Fig. 139). Install Transmission Range Sensor retaining screw (Fig. 139) and torque to 5 N·m (45 in. lbs.).

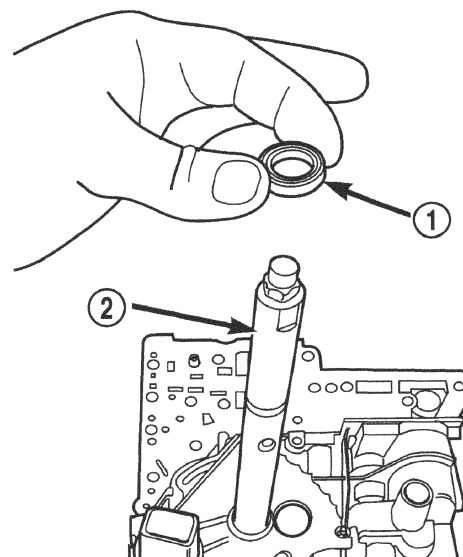


80be466

**Fig. 139 Install Transmission Range Sensor Retaining Screw**

- 1 - TRANSMISSION RANGE SENSOR
- 2 - MANUAL VALVE CONTROL PIN
- 3 - RETAINING SCREW

(18) Install manual shaft seal (Fig. 140).



80be4707

**Fig. 140 Manual Shaft Seal**

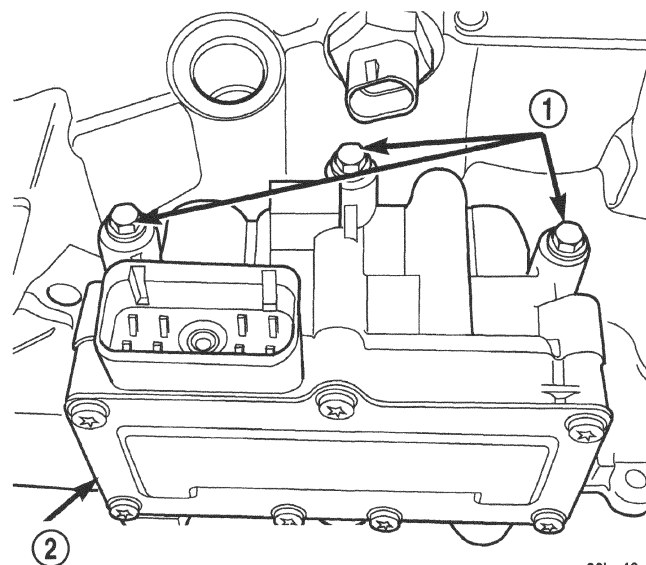
- 1 - SEAL
- 2 - MANUAL SHAFT

**TRANSAXLE—DISASSEMBLY**

**NOTE:** Tag all clutch pack assemblies, as they are removed, for reassembly identification.

**CAUTION:** Do not intermix clutch discs or plates as the unit might then fail.

- (1) Remove input and output speed sensors.
- (2) Remove the three solenoid/pressure switch assembly-to-transaxle case bolts (Fig. 141).



80be46c6

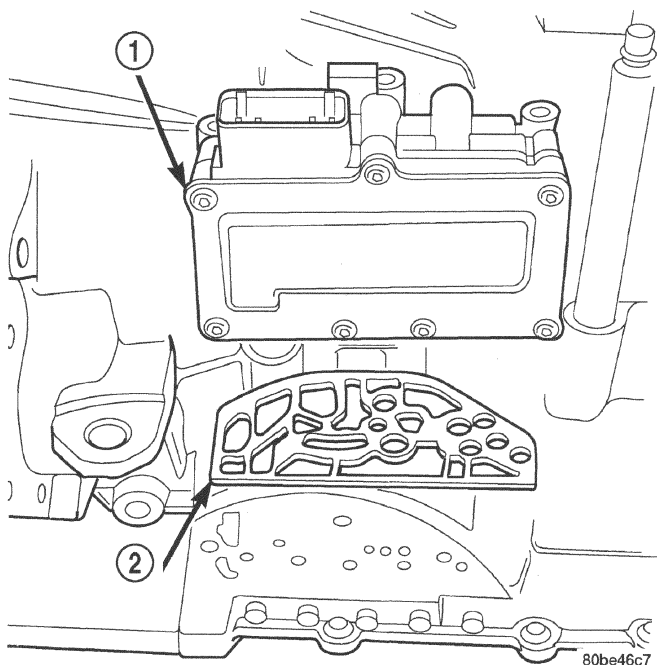
**Fig. 141 Attaching Bolts**

- 1 - BOLTS
- 2 - SOLENOID AND PRESSURE SWITCH ASSEMBLY



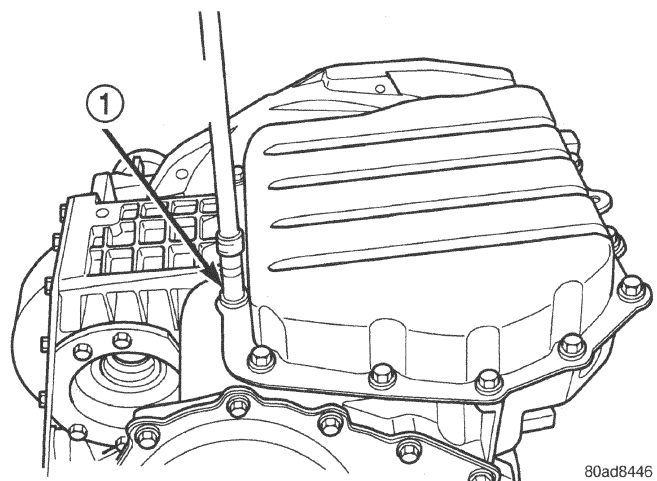
**DISASSEMBLY AND ASSEMBLY (Continued)**

(3) Remove solenoid/pressure switch assembly and gasket (Fig. 142).



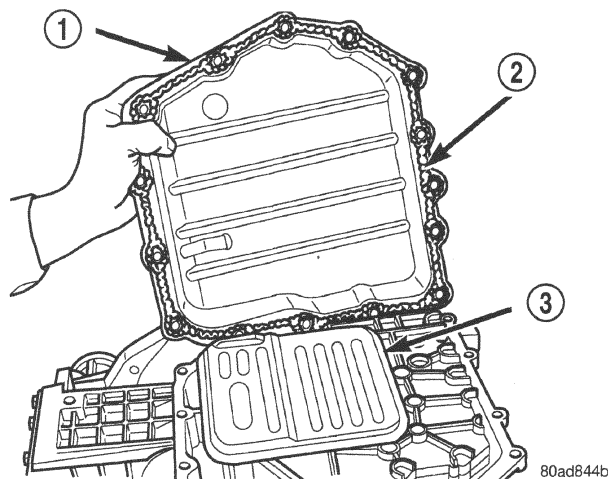
**Fig. 142 Solenoid/Pressure Switch Assembly and Gasket**

- 1 - SOLENOID/PRESSURE SWITCH ASSEMBLY  
2 - GASKET



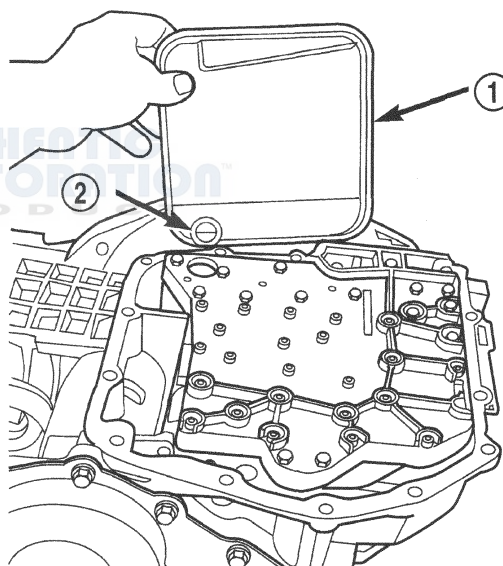
**Fig. 143 Remove Oil Pan Bolts**

- 1 - OIL PAN BOLTS (USE RTV UNDER BOLT HEADS)



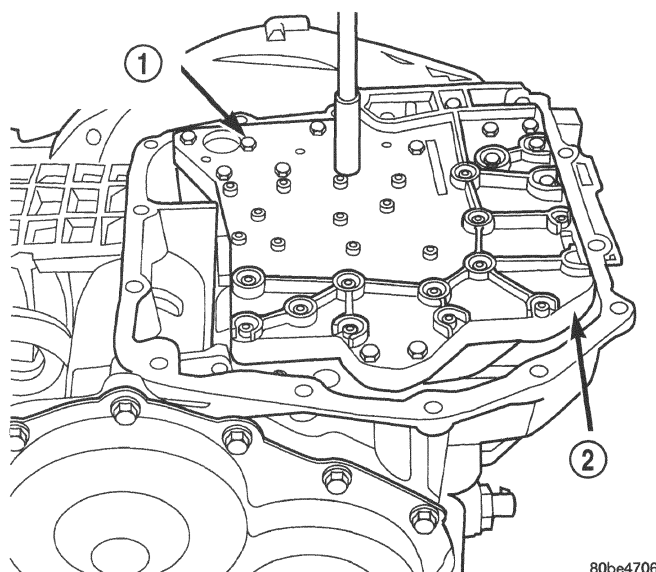
**Fig. 144 Remove Oil Pan**

- 1 - OIL PAN  
2 - 1/8 INCH BEAD OF RTV SEALANT  
3 - OIL FILTER



**Fig. 145 Remove Oil Filter**

- 1 - OIL FILTER  
2 - O-RING

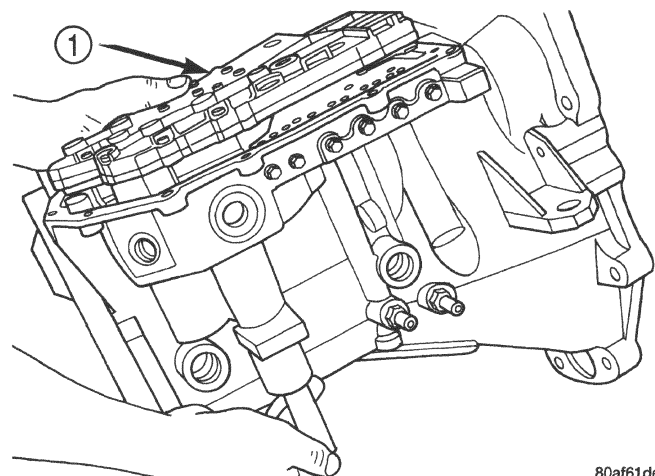
**DISASSEMBLY AND ASSEMBLY (Continued)**

80be4706

**Fig. 146 Remove Valve Body Attaching Bolts**

- 1 - VALVE BODY ATTACHING BOLTS (18)  
 2 - VALVE BODY

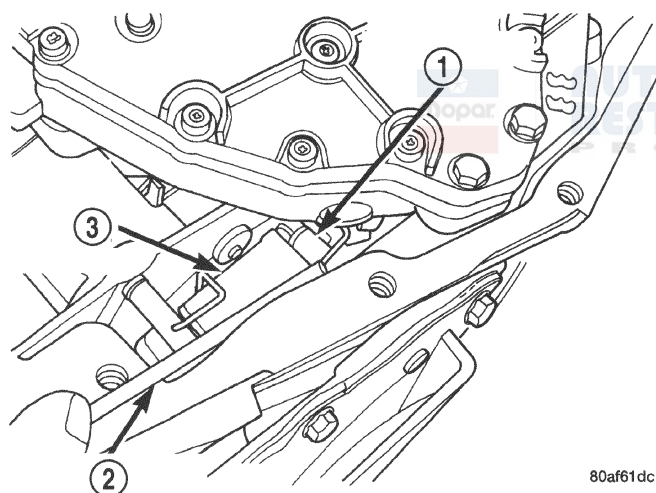
**CAUTION:** Do not handle the valve body from the manual valve. Damage could result.



80af61de

**Fig. 148 Remove Valve Body**

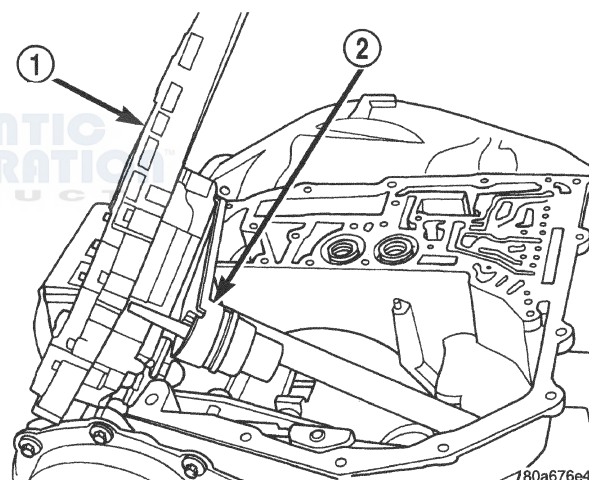
- 1 - VALVE BODY



80af61dc

**Fig. 147 Push Park Rod Rollers from Guide Bracket**

- 1 - PARK SPRAG ROLLERS  
 2 - SCREWDRIVER  
 3 - PARK SPRAG GUIDE BRACKET

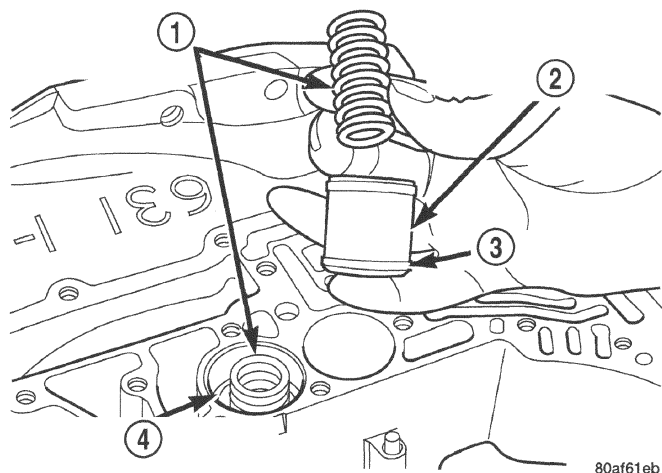


80a676e4

**Fig. 149 Valve Body Removed**

- 1 - VALVE BODY  
 2 - TRANSMISSION RANGE SENSOR

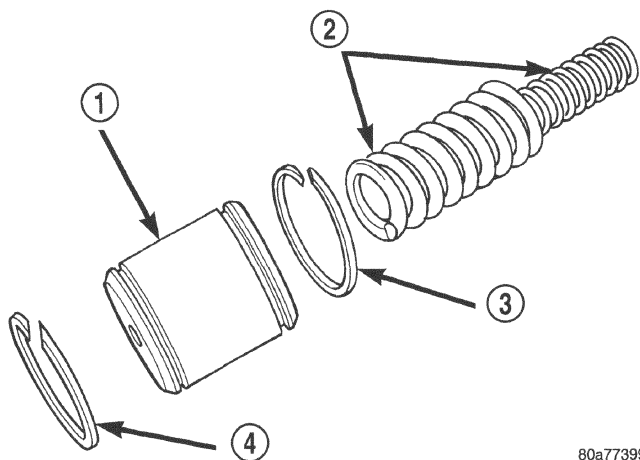
**NOTE:** To ease removal of the valve body, turn the manual valve fully clockwise.

**DISASSEMBLY AND ASSEMBLY (Continued)**

**Fig. 150 Remove Underdrive and Overdrive Accumulators**

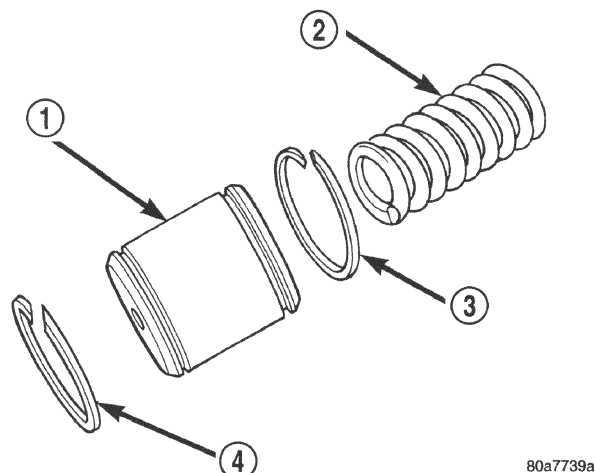
- 1 - RETURN SPRING
- 2 - UNDERDRIVE CLUTCH ACCUMULATOR
- 3 - SEAL RING (2)
- 4 - OVERDRIVE CLUTCH ACCUMULATOR

**NOTE:** Dependent on engine application, some accumulators will have two springs and others will have one spring. The springs are color coded according to application and year. When disassembling, mark accumulator spring location to ease assembly.



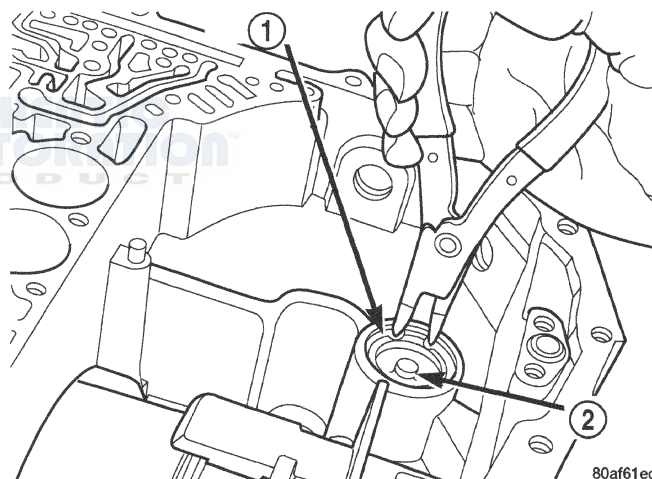
**Fig. 151 Accumulator (Underdrive)**

- 1 - ACCUMULATOR PISTON (UNDERDRIVE)
- 2 - RETURN SPRINGS
- 3 - SEAL RING
- 4 - SEAL RING



**Fig. 152 Accumulator (Overdrive)**

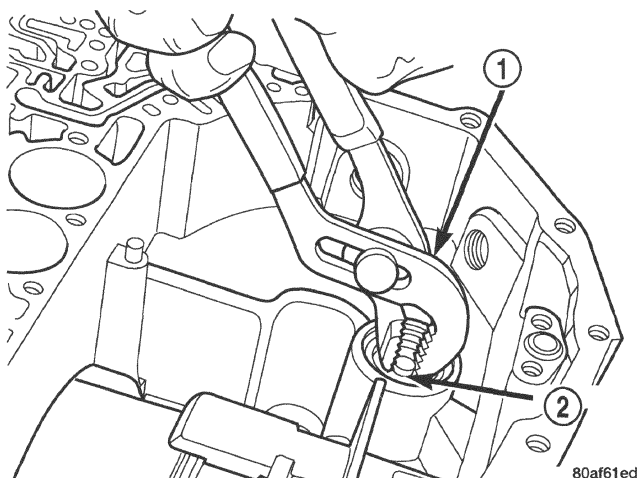
- 1 - ACCUMULATOR PISTON (OVERDRIVE)
- 2 - RETURN SPRING
- 3 - SEAL RING
- 4 - SEAL RING



**Fig. 153 Remove Low/Reverse Accumulator Snap Ring**

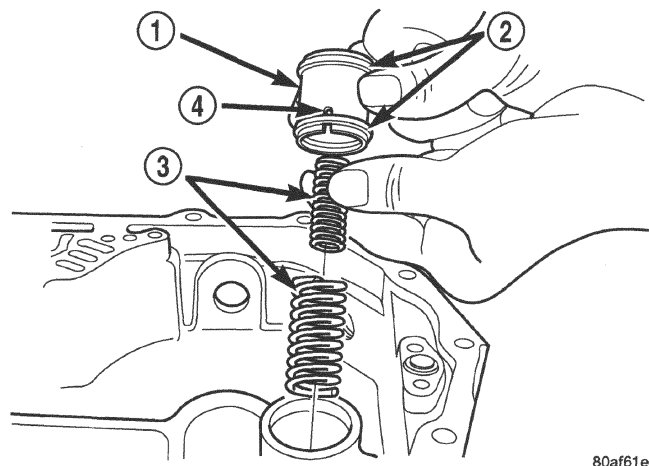
- 1 - SNAP RING
- 2 - PLUG



**DISASSEMBLY AND ASSEMBLY (Continued)**

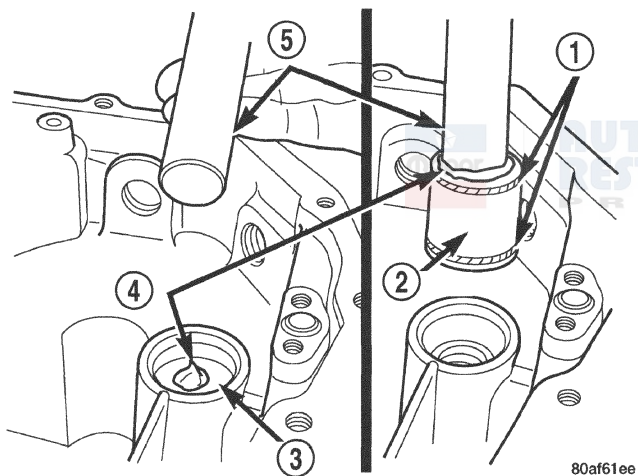
**Fig. 154 Remove Low/Reverse Accumulator Plug (Cover)**

- 1 - ADJUSTABLE PLIERS
- 2 - PLUG



**Fig. 156 Remove Low/Reverse Accumulator**

- 1 - ACCUMULATOR PISTON
- 2 - SEAL RINGS
- 3 - RETURN SPRINGS
- 4 - (NOTE NOTCH)

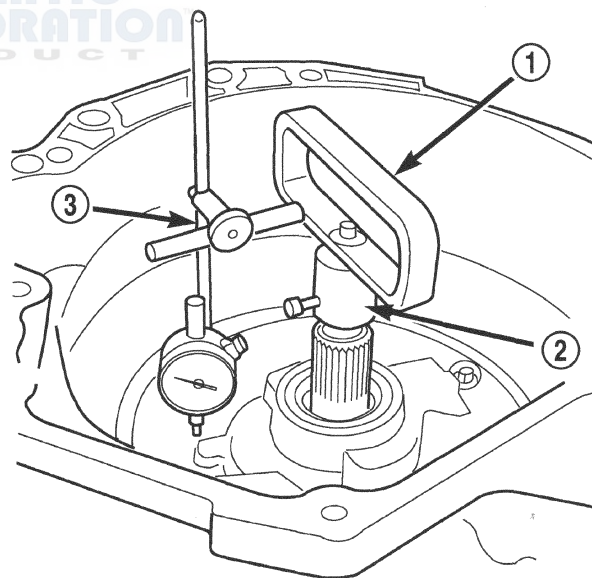


**Fig. 155 Remove Low/Reverse Accumulator Piston**

- 1 - SEAL RINGS
- 2 - PISTON
- 3 - PISTON
- 4 - PETROLATUM
- 5 - SUITABLE TOOL

Set up End Play Set 8266 and Dial Indicator Set C3339 as shown in (Fig. 157). Measure the input shaft end play with the transaxle in the vertical position. This will ensure that the measurement will be accurate.

Measuring input shaft end play before disassembly will usually indicate when a #4 thrust plate change is required. The #4 thrust plate is located behind the overdrive clutch hub.



**Fig. 157 Measure Input Shaft End Play Using End Play Set 8266**

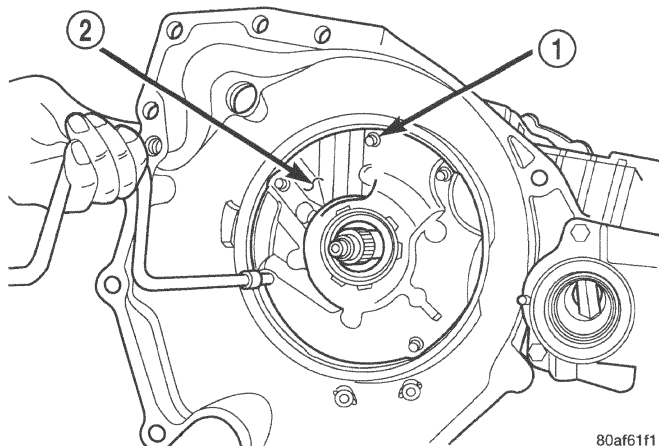
- 1 - TOOL 8266-8
- 2 - TOOL 8266-2
- 3 - TOOL C-3339



**DISASSEMBLY AND ASSEMBLY (Continued)**

Move input shaft in and out to obtain end play reading. End play specifications are 0.13 to 0.64 mm (0.005 to 0.025 inch).

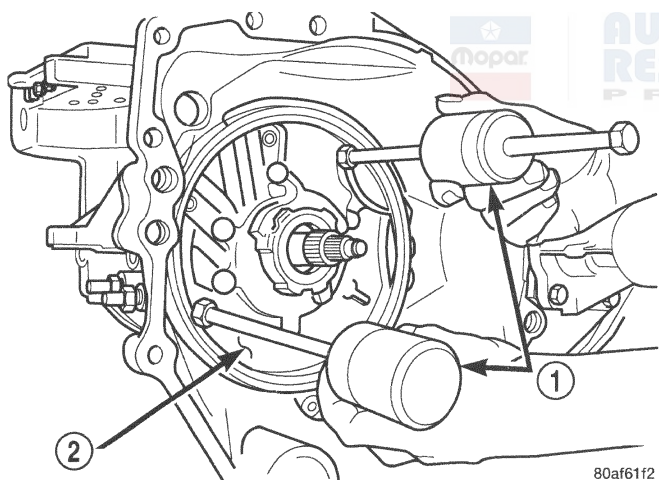
Record indicator reading for reference when reassembling the transaxle.



80af61f1

**Fig. 158 Remove Pump Attaching Bolts**

- 1 - PUMP ATTACHING BOLTS
- 2 - PUMP HOUSING

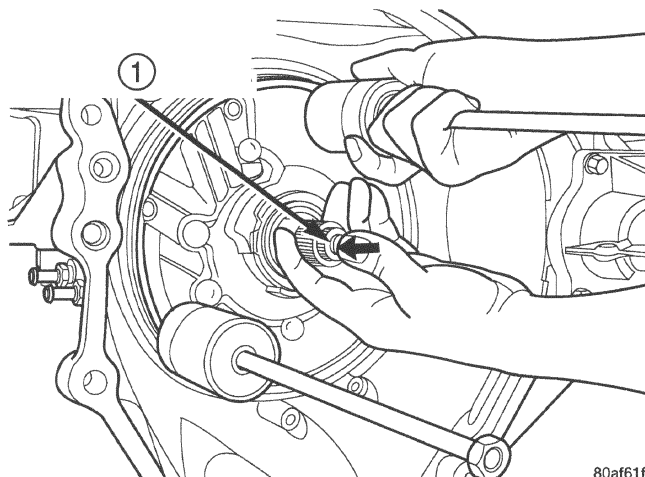


80af61f2

**Fig. 159 Install Tool C-3752**

- 1 - PULLERS TOOL C-3752
- 2 - PUMP

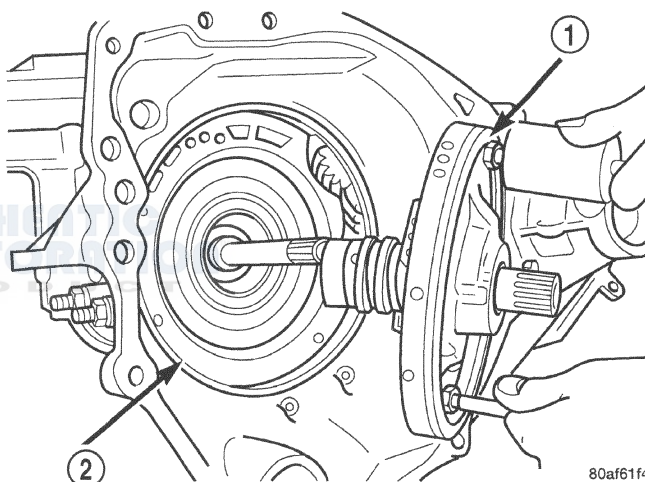
**CAUTION:** Be sure input speed sensor is removed before removing oil pump.



80af61f3

**Fig. 160 Remove Oil Pump**

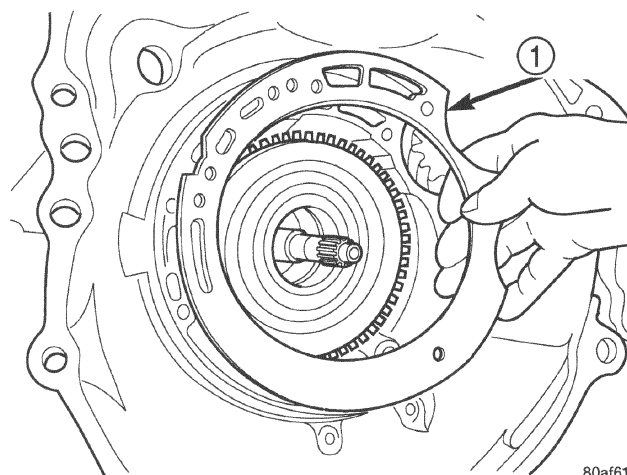
- 1 - "PUSH IN" ON INPUT SHAFT WHILE REMOVING PUMP



80af61f4

**Fig. 161 Oil Pump Removed**

- 1 - OIL PUMP
- 2 - GASKET



80af61f5

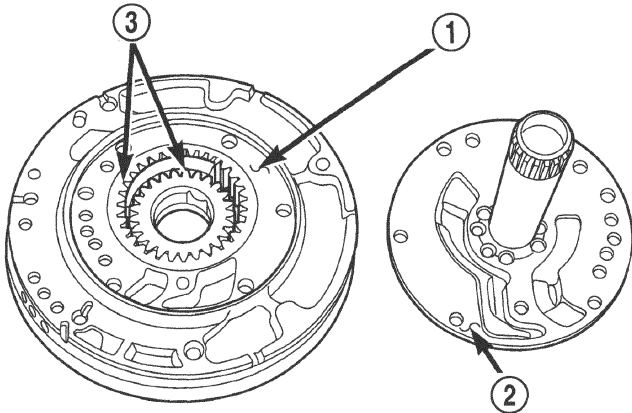
**Fig. 162 Remove Oil Pump Gasket**

- 1 - PUMP GASKET

**DISASSEMBLY AND ASSEMBLY (Continued)****OIL PUMP INSPECTION**

When disassembling the transaxle it is necessary to inspect the oil pump for wear and damage.

- (1) Remove the reaction shaft support bolts.
- (2) Remove reaction shaft support from pump housing (Fig. 163).



80b04ebc

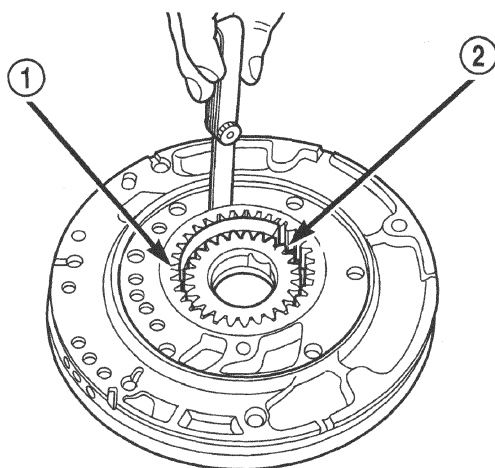
**Fig. 163 Reaction Shaft Support**

- 1 - PUMP HOUSING
- 2 - REACTION SHAFT SUPPORT
- 3 - PUMP GEARS

- (3) Remove the pump gears and check for wear and damage.

- (4) Install the gears and check clearances.

- (5) Measure the clearance between the outer gear and the pump pocket (Fig. 164). Clearance should be 0.045-0.141mm (0.0018-0.0056 in.)



80b04ebb

**Fig. 164 Measure Outer Gear to Pocket**

- 1 - OUTER GEAR
- 2 - POCKET

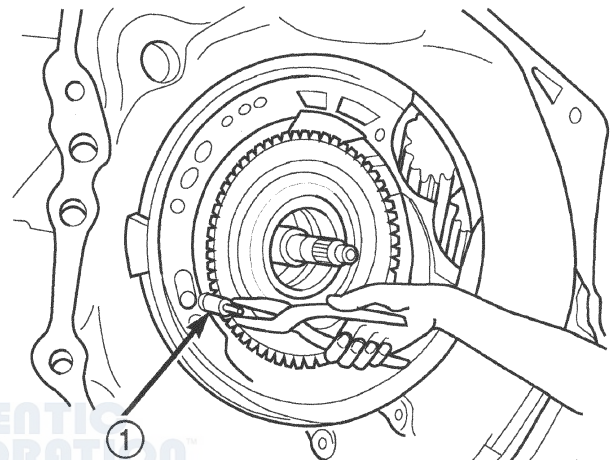
- (6) Position an appropriate piece of Plastigage across both pump gears.

- (7) Align the Plastigage to a flat area on the reaction shaft support housing.

- (8) Install the reaction shaft to the pump housing. Tighten the bolts to 27 N·M (20 ft. lbs.)

- (9) Remove bolts and carefully separate the housings. Measure the Plastigage following the instructions supplied.

- (10) Clearance between outer gear side and the reaction shaft support should be 0.020-0.046mm (0.008-0.0018 in.). Clearance between inner gear side and the reaction shaft support should be 0.020-0.046mm (0.008-0.0018 in.).

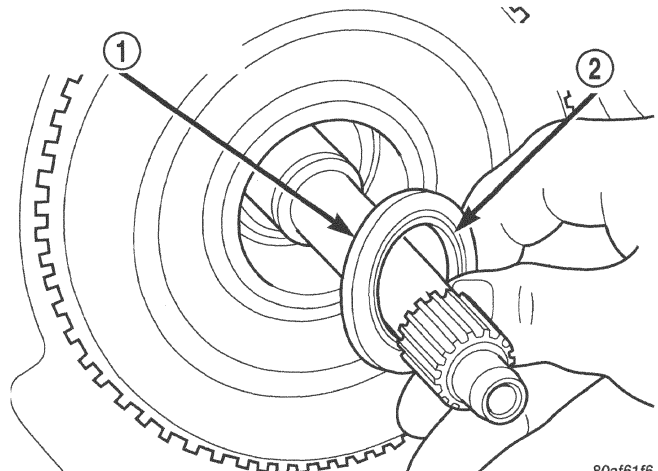


80af61fe

**Fig. 165 Remove Bypass Valve**

- 1 - COOLER BYPASS VALVE

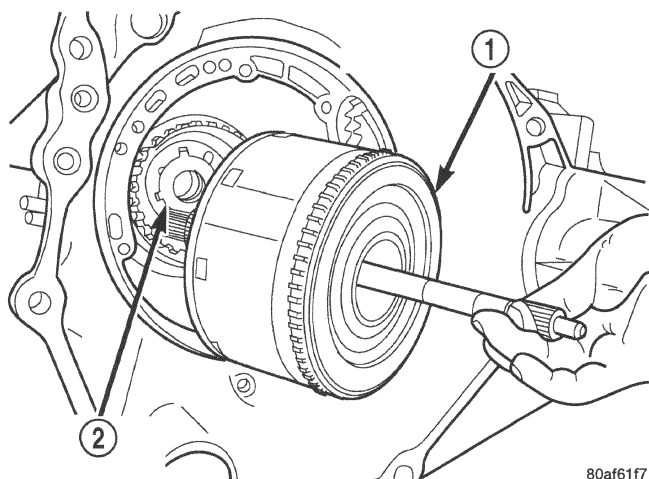
**CAUTION:** The cooler bypass valve must be replaced if a transaxle failure has occurred. Do not reuse old valve or attempt to clean old valve. When installing bypass valve, insert with O-ring end towards rear of case.



80af61f6

**Fig. 166 Remove Caged Needle Bearing**

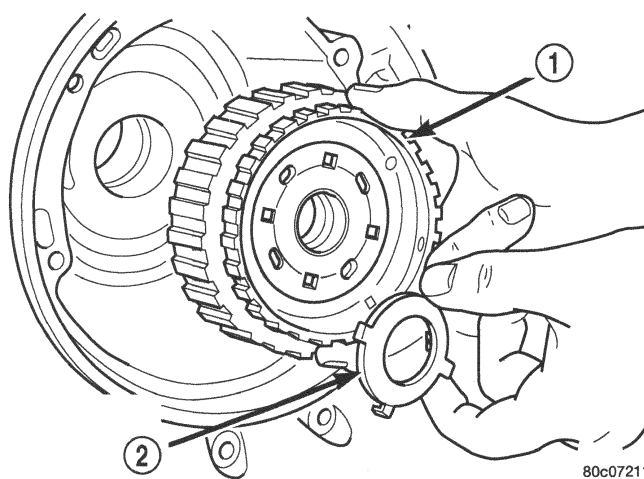
- 1 - #1 CAGED NEEDLE BEARING
- 2 - NOTE: TANGED SIDE OUT

**DISASSEMBLY AND ASSEMBLY (Continued)**

80af61f7

**Fig. 167 Remove Input Clutches Assembly**

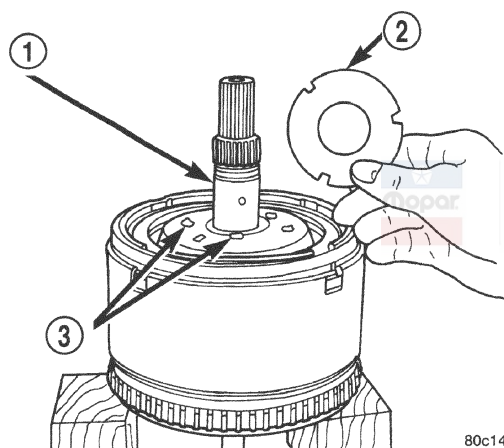
- 1 - INPUT CLUTCHES ASSEMBLY
- 2 - #4 THRUST WASHER



80c07211

**Fig. 169 Remove Front Sun Gear Assembly**

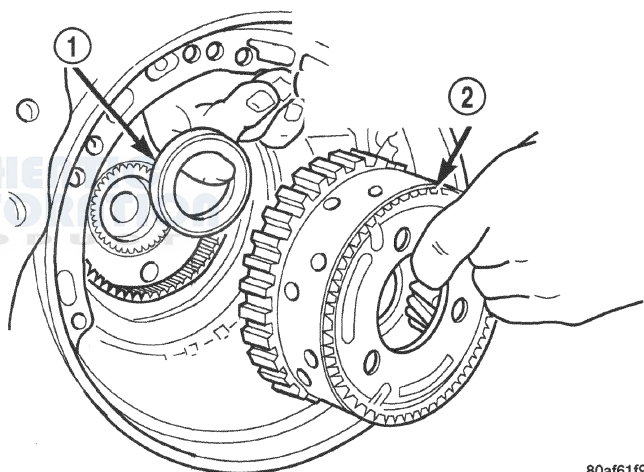
- 1 - FRONT SUN GEAR ASSEMBLY
- 2 - #4 THRUST WASHER (FOUR TABS)



80c140f6

**Fig. 168 No. 4 Thrust Plate**

- 1 - OVERDRIVE SHAFT ASSEMBLY
- 2 - #4 THRUST PLATE (SELECT)
- 3 - 3 DABS OF PETROLATUM FOR RETENTION

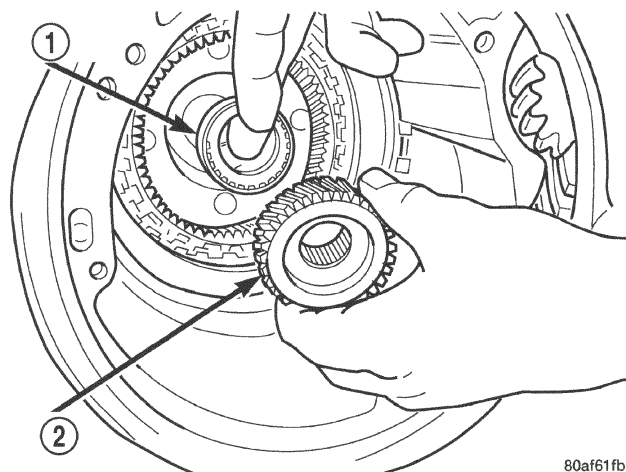


80af61f9

**Fig. 170 Remove Front Carrier and Rear Annulus Assembly**

- 1 - #6 NEEDLE BEARING
- 2 - FRONT CARRIER AND REAR ANNULUS ASSEMBLY (TWIST AND PULL OR PUSH TO REMOVE OR INSTALL).

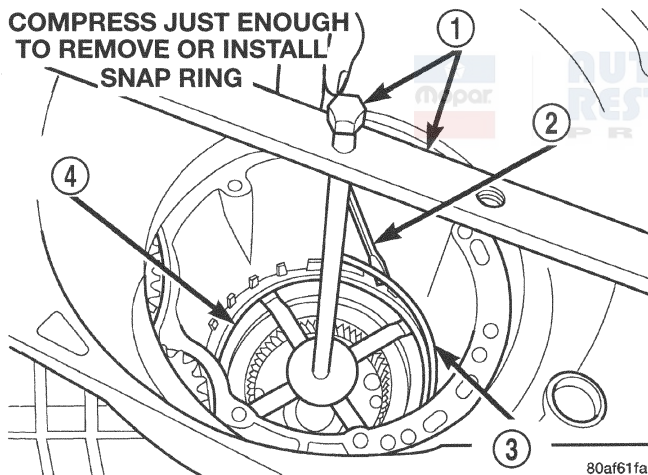


**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 171 Remove Rear Sun Gear**

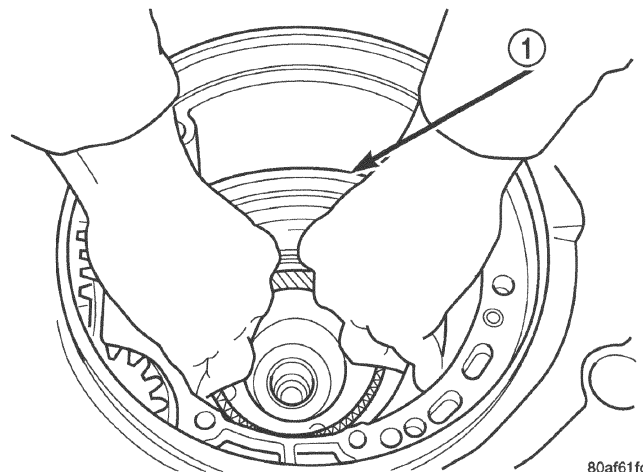
- 1 - #7 NEEDLE BEARING
- 2 - REAR SUN GEAR

**NOTE:** Verify that Miller Tool 5058 is centered properly to the 2/4 clutch retainer before depressing the tool.

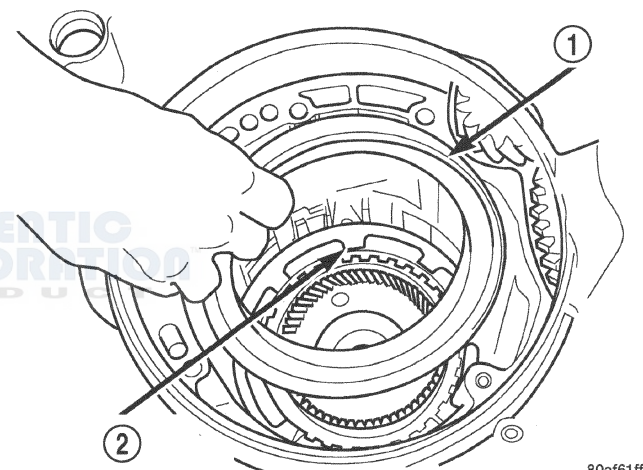
**COMPRESS JUST ENOUGH  
TO REMOVE OR INSTALL  
SNAP RING**

**Fig. 172 Remove 2/4 Clutch Retainer Snap Ring**

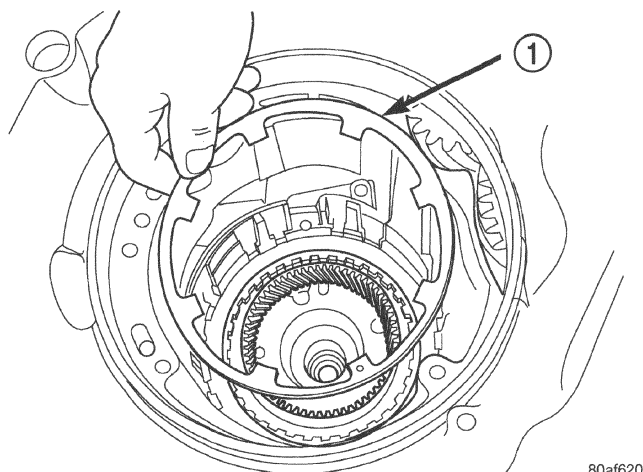
- 1 - TOOL 5058
- 2 - SCREWDRIVER
- 3 - SNAP RING
- 4 - 2/4 CLUTCH RETAINER

**Fig. 173 Remove 2/4 Clutch Retainer**

- 1 - 2/4 CLUTCH RETAINER

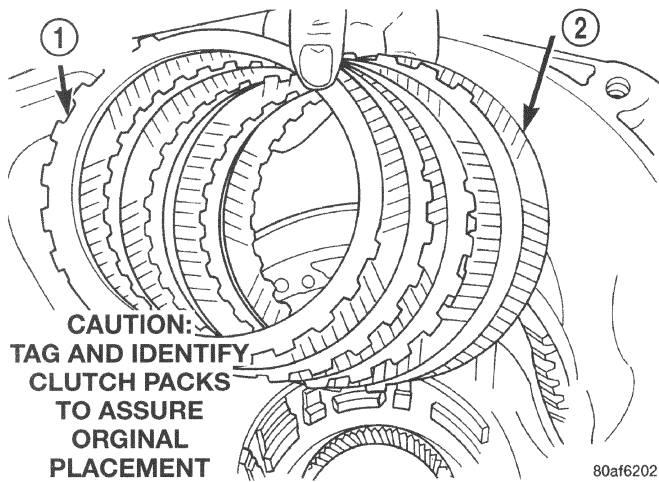
**Fig. 174 2/4 Clutch Retainer**

- 1 - 2/4 CLUTCH RETAINER
- 2 - 2/4 CLUTCH RETURN SPRING

**Fig. 175 Remove 2/4 Clutch Return Spring**

- 1 - 2/4 CLUTCH RETURN SPRING



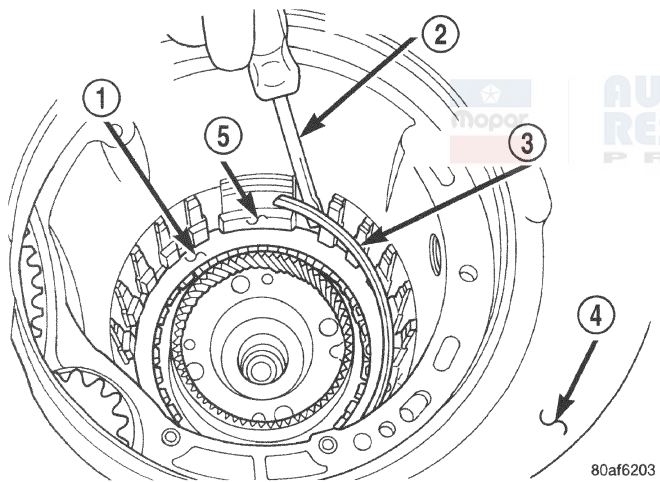
**DISASSEMBLY AND ASSEMBLY (Continued)**

80af6202

**Fig. 176 Remove 2/4 Clutch Pack**

- 1 - CLUTCH PLATE (4)
- 2 - CLUTCH DISC (4)

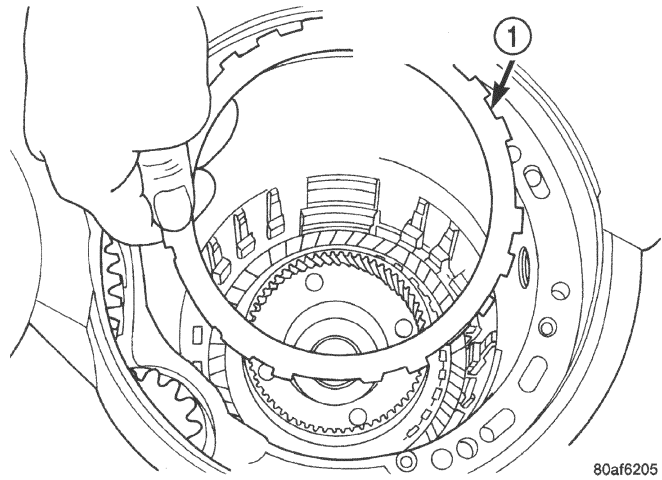
**NOTE:** Tag 2/4 clutch pack for reassembly identification.



80af6203

**Fig. 177 Remove Tapered Snap Ring**

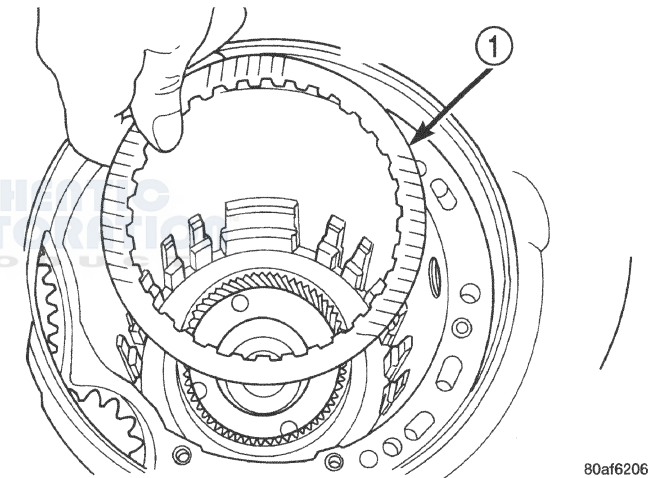
- 1 - LOW/REVERSE CLUTCH REACTION PLATE
- 2 - SCREWDRIVER
- 3 - LOW/REVERSE TAPERED SNAP RING (TAPERED SIDE UP)
- 4 - OIL PAN FACE
- 5 - LONG TAB



80af6205

**Fig. 178 Remove Low/Reverse Reaction Plate**

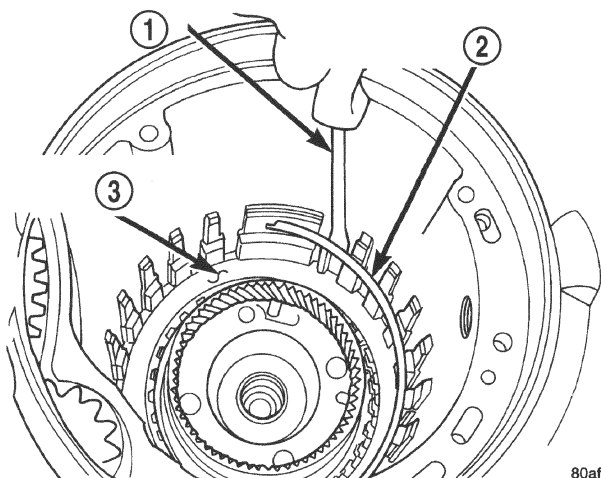
- 1 - LOW/REVERSE REACTION PLATE (FLAT SIDE UP)



80af6206

**Fig. 179 Remove One Disc**

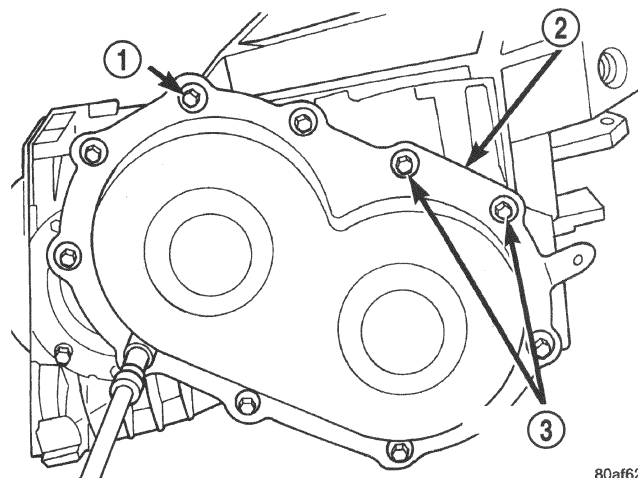
- 1 - ONE DISC FROM LOW/REVERSE CLUTCH

**DISASSEMBLY AND ASSEMBLY (Continued)**

80af6207

**Fig. 180 Remove Low/Reverse Reaction Plate Snap Ring**

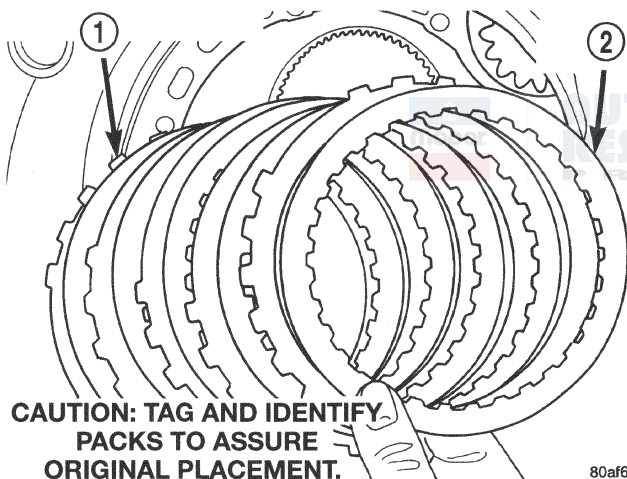
- 1 - SCREWDRIVER
- 2 - LOW/REVERSE REACTION PLATE FLAT SNAP RING
- 3 - DO NOT SCRATCH CLUTCH PLATE



80af6209

**Fig. 182 Remove Rear Cover Bolts**

- 1 - REAR COVER BOLTS
- 2 - REAR COVER
- 3 - USE SEALANT ON BOLTS

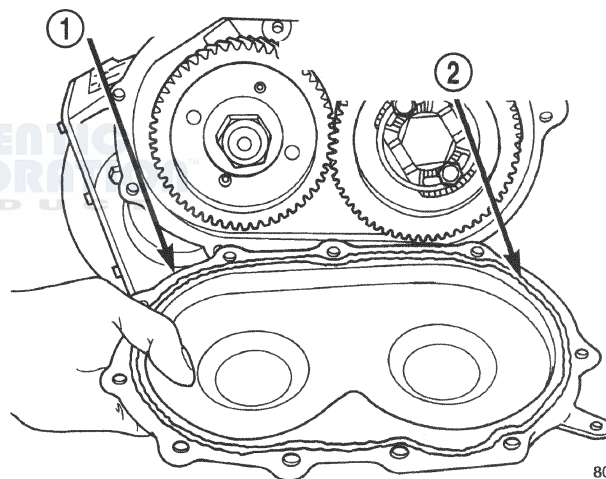


80af6208

**CAUTION: TAG AND IDENTIFY PACKS TO ASSURE ORIGINAL PLACEMENT.**

**Fig. 181 Remove Low/Reverse Clutch Pack**

- 1 - CLUTCH PLATES (5)
- 2 - CLUTCH DISCS (5)

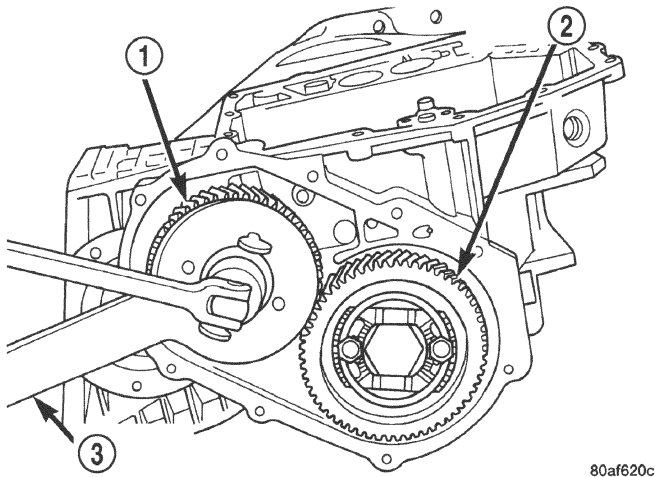


80af620b

**Fig. 183 Remove Rear Cover**

- 1 - REAR COVER
- 2 - 1/8 INCH BEAD OF MOPAR SILICONE RUBBER ADHESIVE SEALANT AS SHOWN

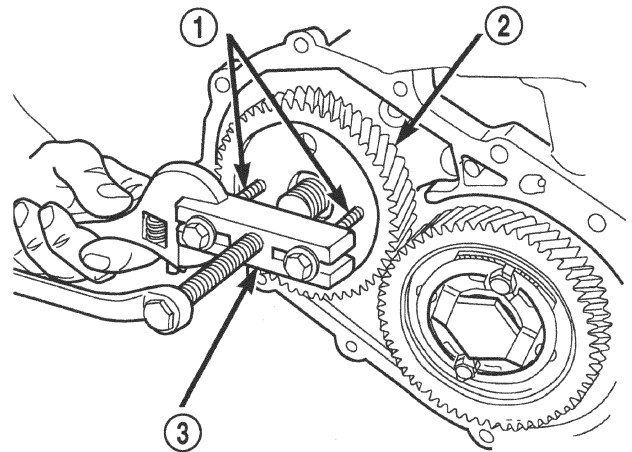
**NOTE: Tag low/reverse clutch pack for reassembly identification.**

**DISASSEMBLY AND ASSEMBLY (Continued)**

80af620c

**Fig. 184 Remove Transfer Shaft Gear Nut**

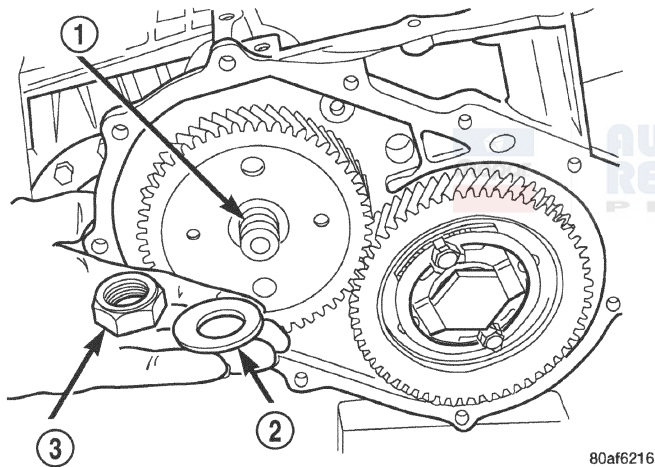
- 1 - TRANSFER SHAFT GEAR
- 2 - OUTPUT GEAR
- 3 - SPECIAL TOOL 6259



80af6215

**Fig. 186 Remove Transfer Shaft Gear**

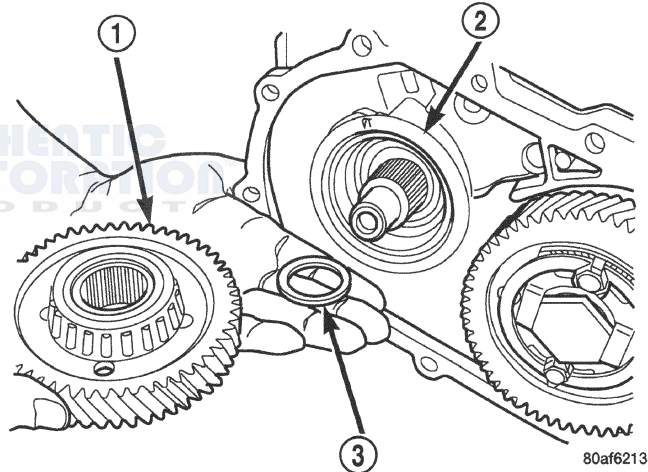
- 1 - SPECIAL TOOL L-4407-6
- 2 - TRANSFER SHAFT GEAR
- 3 - SPECIAL TOOL L-4407



80af6216

**Fig. 185 Transfer Shaft Gear Nut and Coned Washer**

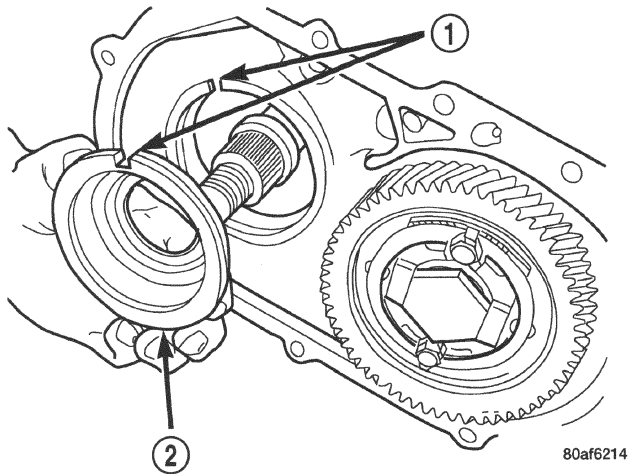
- 1 - TRANSFER SHAFT
- 2 - LOCK WASHER
- 3 - NUT



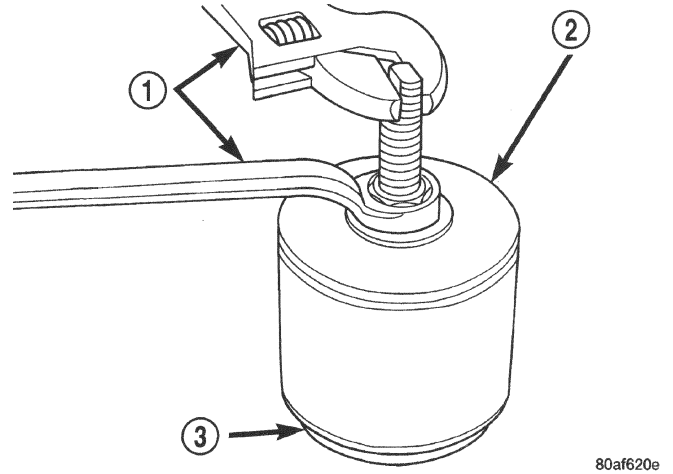
80af6213

**Fig. 187 Remove Transfer Shaft Gear and (Select) Shim**

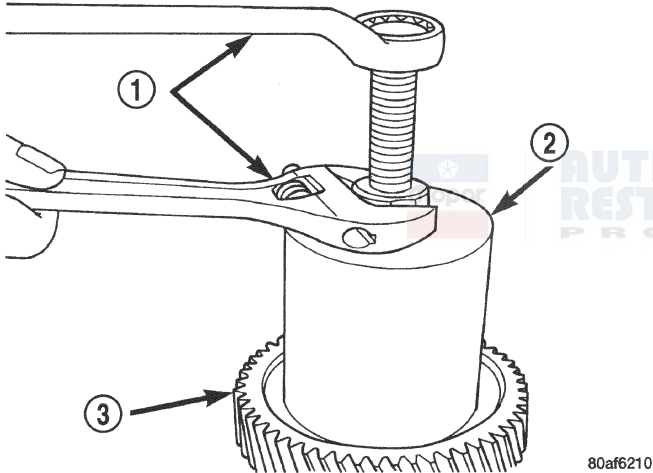
- 1 - TRANSFER SHAFT GEAR
- 2 - BEARING CUP RETAINER
- 3 - SHIM (SELECT)

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 188 Remove Bearing Cup Retainer**

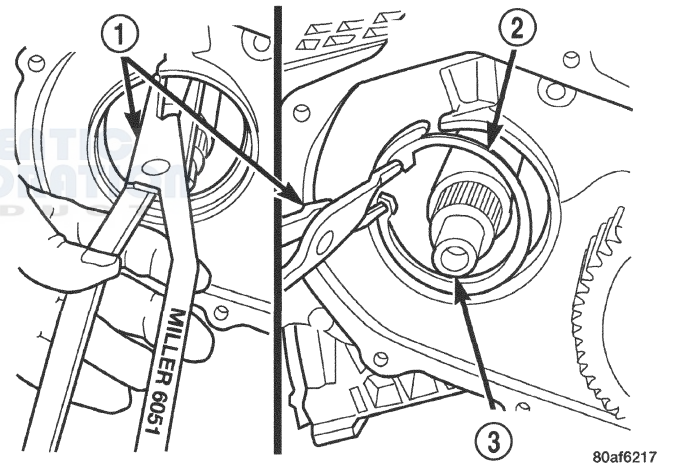
- 1 - ALIGN INDEXING TAB TO SLOT
- 2 - BEARING CUP RETAINER

**Fig. 190 Remove Transfer Shaft Bearing Cup**

- 1 - WRENCHES
- 2 - TOOL 6062
- 3 - TRANSFER SHAFT BEARING CUP RETAINER

**Fig. 189 Remove Transfer Gear Bearing Cone**

- 1 - WRENCHES
- 2 - TOOL 5048 WITH JAWS TOOL 5048-4 AND BUTTON TOOL L-4539-2
- 3 - TRANSFER SHAFT GEAR

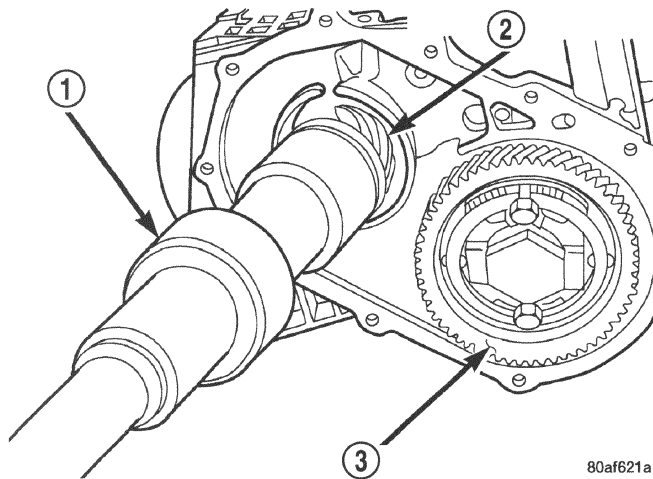
**Fig. 191 Remove Transfer Shaft Bearing Snap Ring**

- 1 - SNAP RING PLIERS TOOL 6051
- 2 - TRANSFER SHAFT BEARING SNAP RING
- 3 - TRANSFER SHAFT



**DISASSEMBLY AND ASSEMBLY (Continued)**

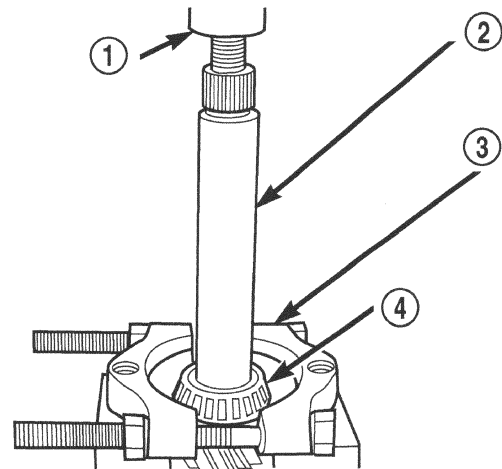
**NOTE:** Screw Tool 5049-A onto transfer shaft.  
Remove transfer shaft.



80af621a

**Fig. 192 Remove Transfer Shaft**

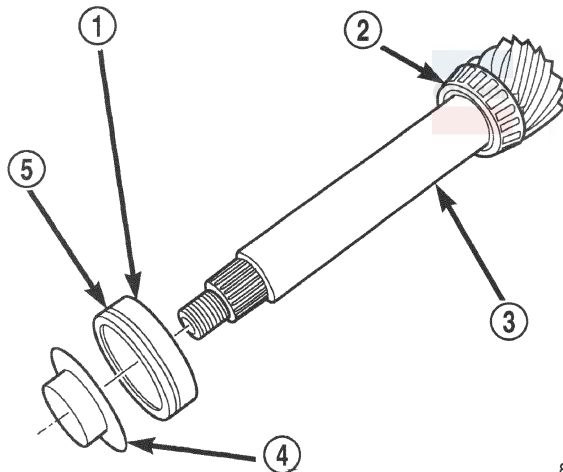
- 1 - SPECIAL TOOL 5049-A
- 2 - TRANSFER SHAFT
- 3 - OUTPUT GEAR



80af621b

**Fig. 194 Remove Transfer Shaft Bearing Cone**

- 1 - ARBOR PRESS RAM
- 2 - TRANSFER SHAFT
- 3 - TOOL P-334
- 4 - BEARING CONE



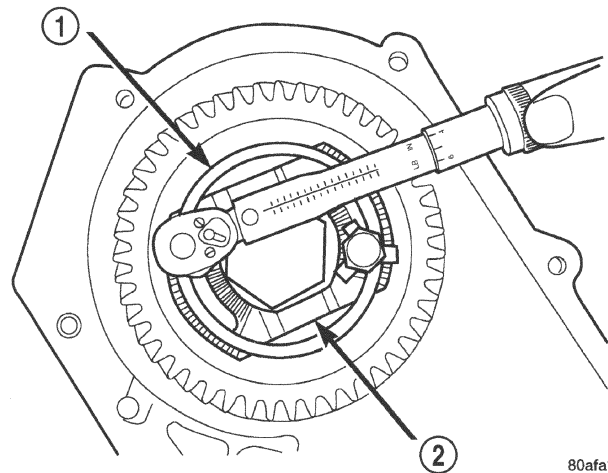
80af621c

**Fig. 193 Bearing Cup Removed**

- 1 - BEARING CUP
- 2 - BEARING CONE
- 3 - TRANSFER SHAFT
- 4 - OIL BAFFLE
- 5 - O-RING

**NOTE:** Remove output gear stirrup and strap bolts.

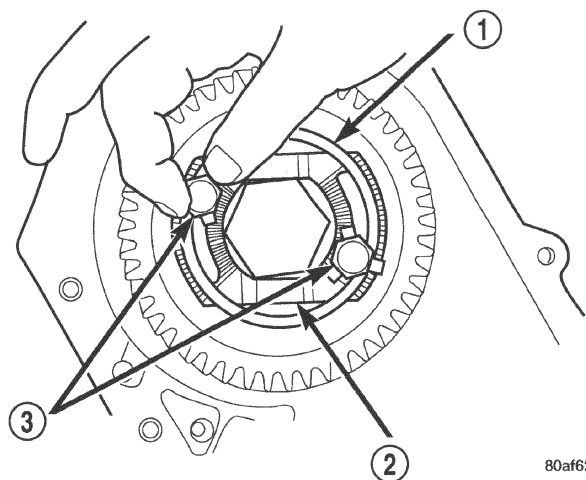
All transaxles utilize a stirrup and retaining strap that is attached to the output gear. The stirrup prevents the output gear retaining bolt from turning and backing out of the rear carrier. The strap is used to hold the stirrup to the output gear and prevent the stirrup retaining bolts from backing out.



80afa16e

**Fig. 195 Loosen Stirrup Strap Bolts**

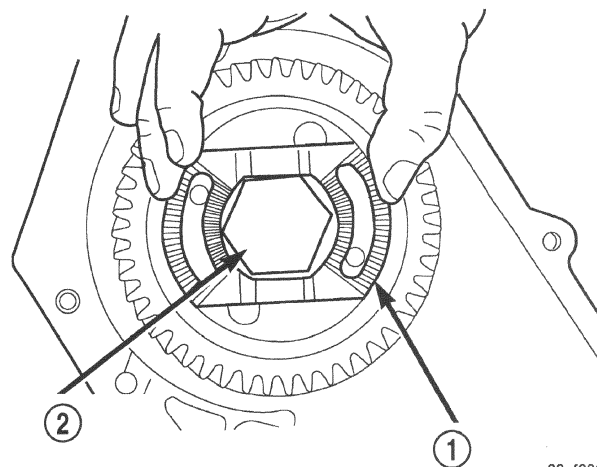
- 1 - RETAINING STRAP
- 2 - STIRRUP

**DISASSEMBLY AND ASSEMBLY (Continued)**

80af6222

**Fig. 196 Remove Strap Bolts**

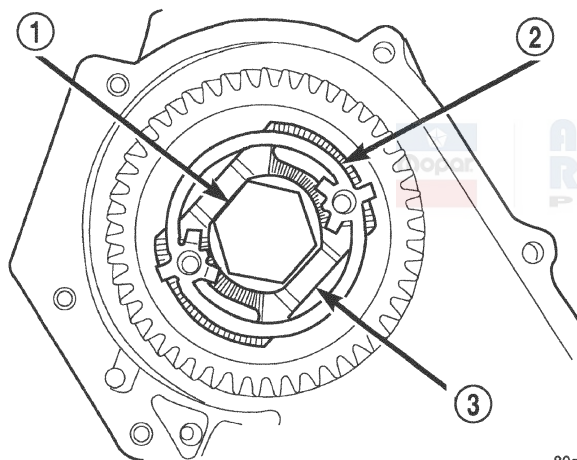
- 1 - RETAINING STRAP
- 2 - STIRRUP
- 3 - RETAINING STRAP BOLTS



80af6220

**Fig. 198 Remove Stirrup**

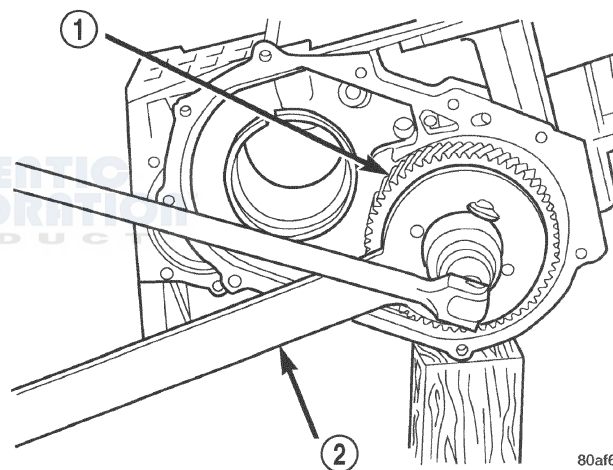
- 1 - STIRRUP
- 2 - OUTPUT GEAR RETAINING BOLT



80af6221

**Fig. 197 Remove Stirrup Strap**

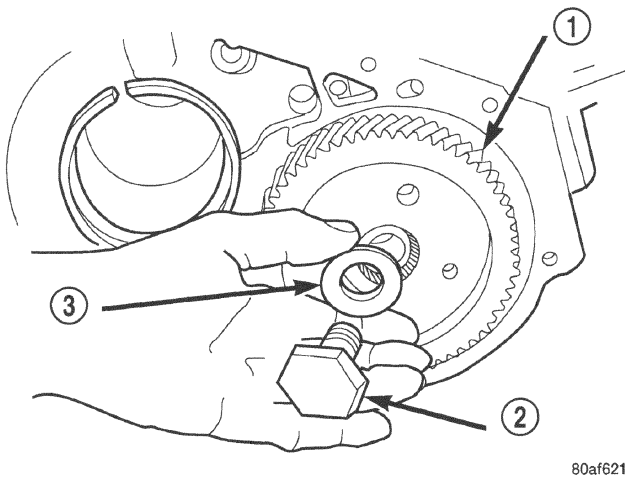
- 1 - OUTPUT GEARBOLT
- 2 - RETAINING STRAP
- 3 - STIRRUP



80af6219

**Fig. 199 Remove Output Gear Bolt**

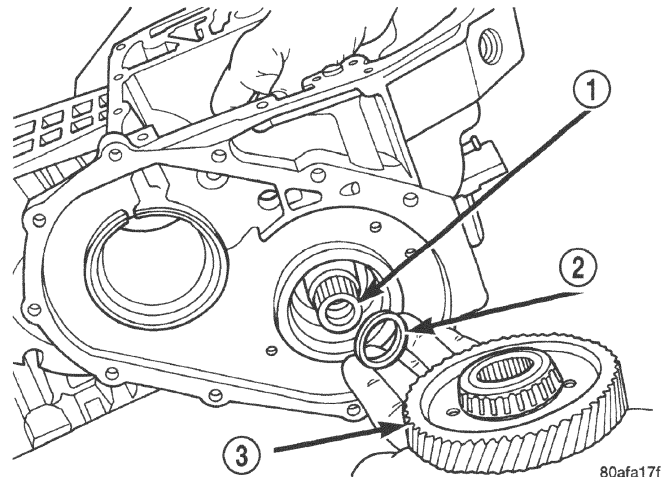
- 1 - OUTPUT GEAR
- 2 - TOOL 6259

**DISASSEMBLY AND ASSEMBLY (Continued)**

80af621e

**Fig. 200 Output Gear Bolt and Washer**

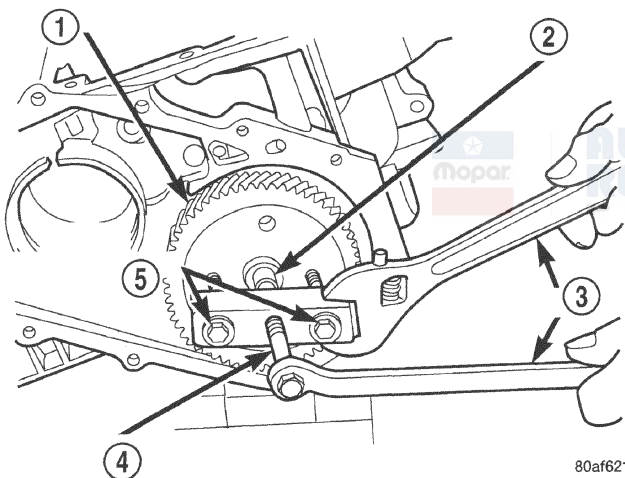
- 1 - OUTPUT GEAR
- 2 - BOLT
- 3 - CONED LOCK WASHER



80afa17f

**Fig. 202 Output Gear and (Select) Shim**

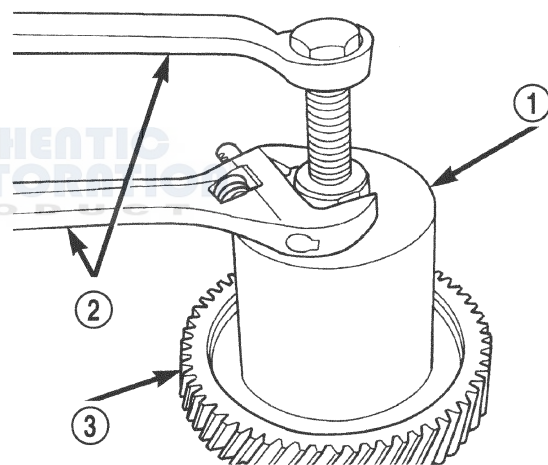
- 1 - REAR CARRIER ASSEMBLY
- 2 - SHIM (SELECT)
- 3 - OUTPUT GEAR



80af6211

**Fig. 201 Remove Output Gear**

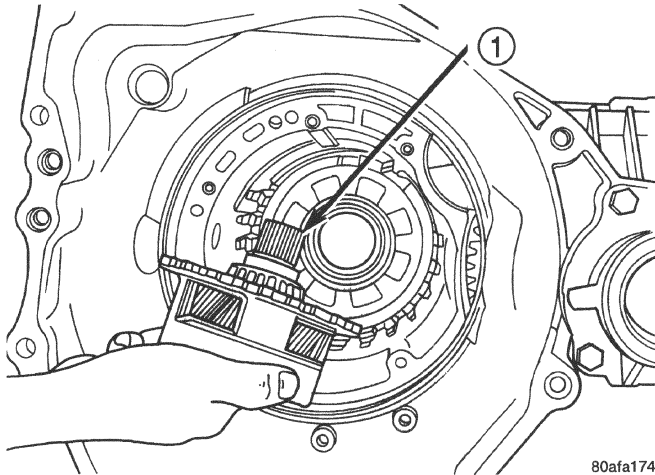
- 1 - OUTPUT GEAR
- 2 - BUTTON TOOL 6055
- 3 - WRENCHES
- 4 - TOOL L-4407
- 5 - BOLTS TOOL L-4407-6



80afa180

**Fig. 203 Remove Bearing Cone**

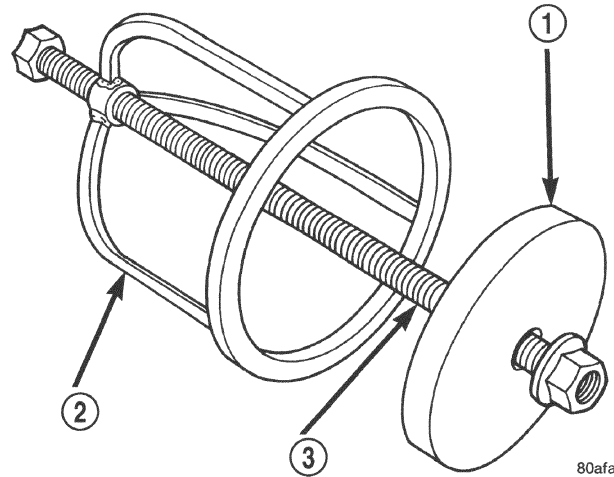
- 1 - TOOL 5048 WITH JAWS 5048-5 AND BUTTON L-4539-2
- 2 - WRENCHES
- 3 - OUTPUT GEAR

**DISASSEMBLY AND ASSEMBLY (Continued)**

80afa174

**Fig. 204 Remove Rear Carrier Assembly**

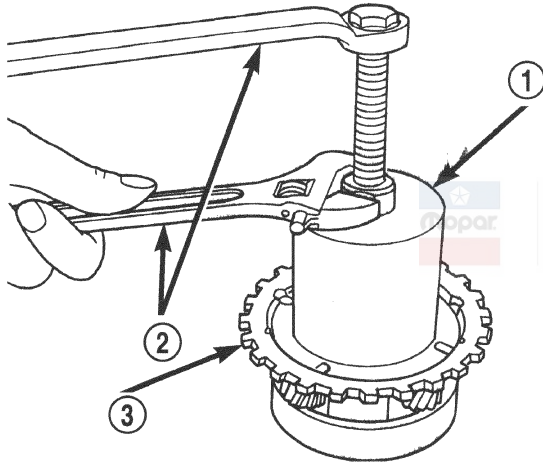
1 - REAR CARRIER ASSEMBLY



80afa177

**Fig. 206 Low/Reverse Spring Compressor Tool**

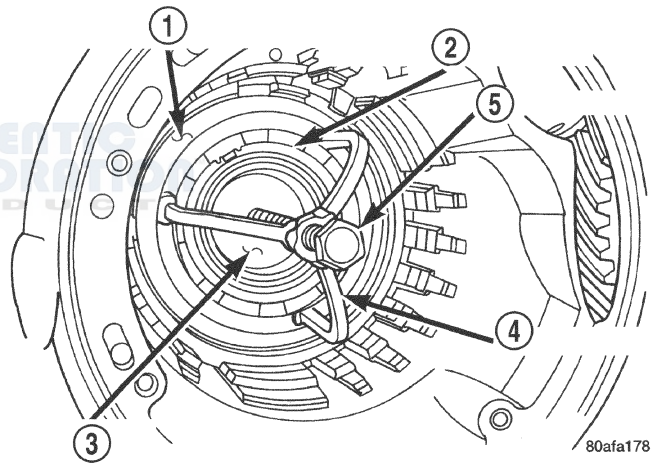
1 - TOOL 6057  
 2 - TOOL 5059  
 3 - TOOL 5058-3



80afa175

**Fig. 205 Remove Rear Carrier Bearing Cone**

1 - TOOL 5048 WITH JAWS 5048-3 AND BUTTON 6055  
 2 - WRENCHES  
 3 - REAR CARRIER ASSEMBLY

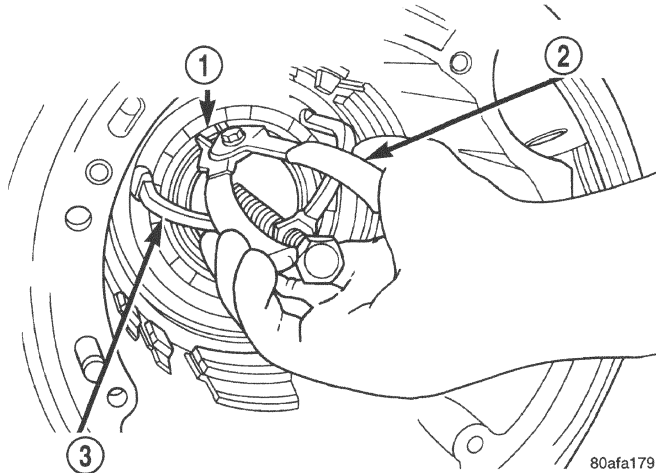


80afa178

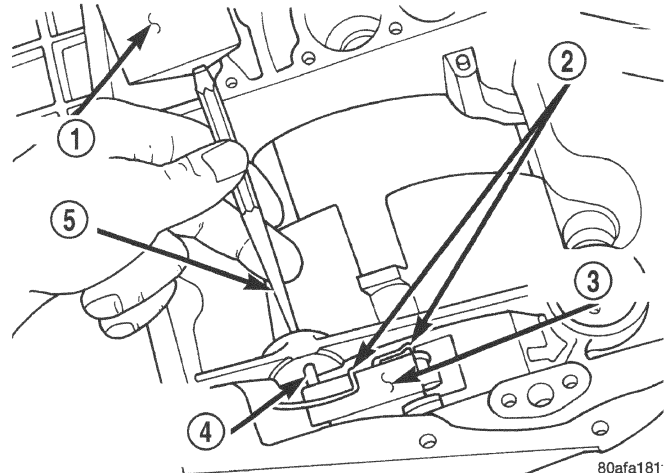
**Fig. 207 Compressor Tool in Use**

1 - LOW/REVERSE CLUTCH RETURN SPRING  
 2 - SNAP RING (INSTALL AS SHOWN)  
 3 - TOOL 6057  
 4 - TOOL 5059  
 5 - TOOL 5058-3



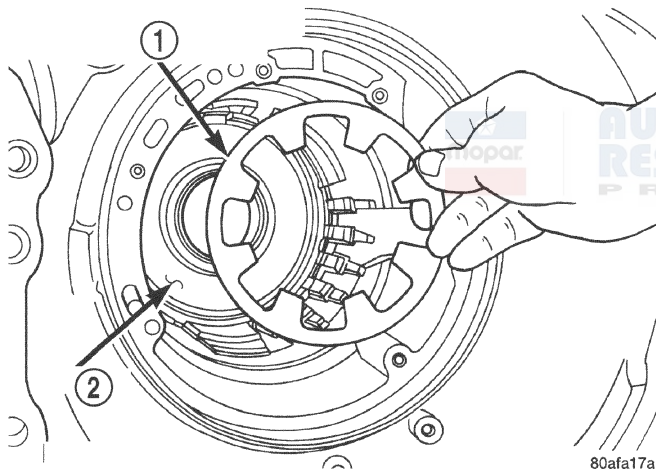
**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 208 Remove Snap Ring**

- 1 - SNAP RING OPENING MUST BE BETWEEN SPRING LEVERS (AS SHOWN)
- 2 - SNAP RING PLIERS
- 3 - TOOL 6057

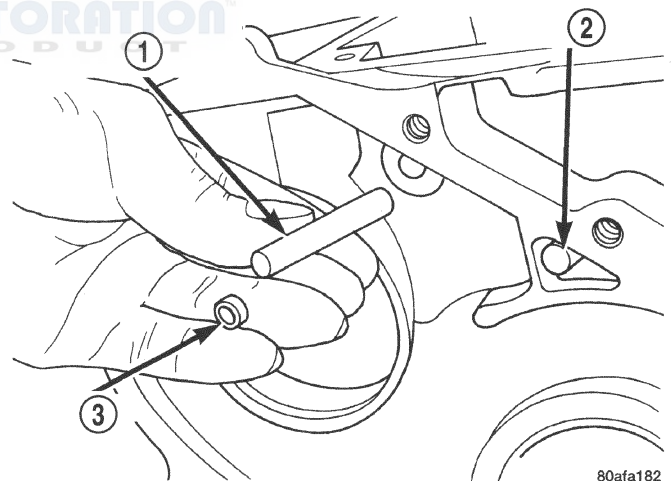
**Fig. 210 Drive Out Anchor Shaft**

- 1 - HAMMER
- 2 - ANTIRATCHET SPRING
- 3 - GUIDE BRACKET
- 4 - PARK SPRAG GUIDE BRACKET ANCHOR SHAFT
- 5 - DRIFT

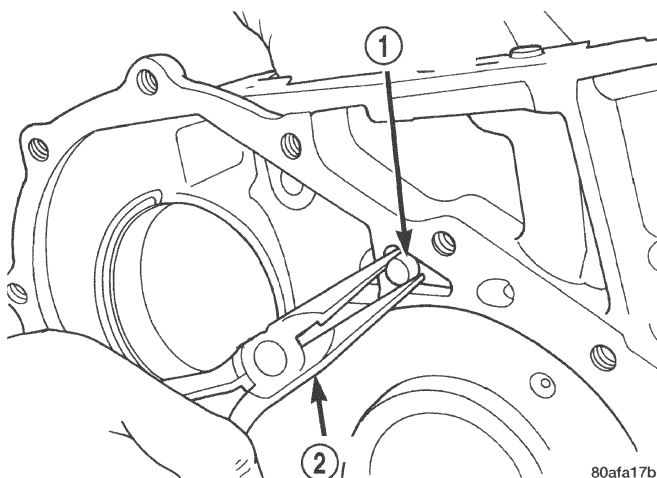
**CAUTION:** When installing, be sure guide bracket and split sleeve touch the rear of the transaxle case.

**Fig. 209 Low/Reverse Piston Return Spring**

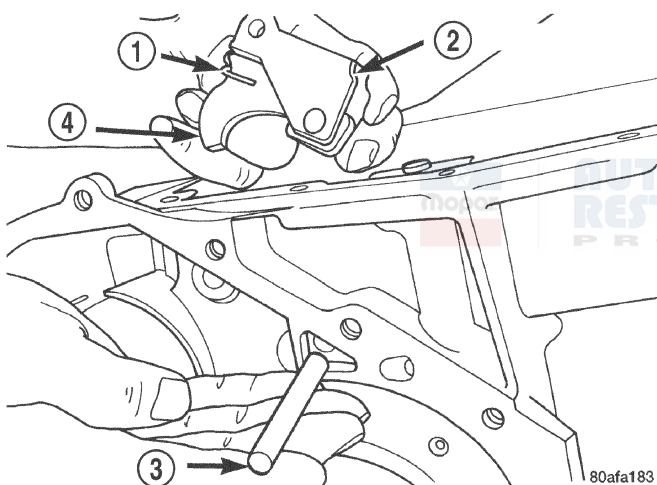
- 1 - LOW/REVERSE PISTON RETURN SPRING
- 2 - PISTON

**Fig. 211 Remove Anchor Shaft and Plug**

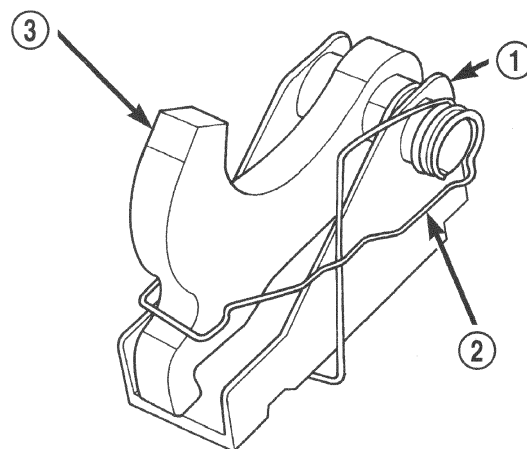
- 1 - GUIDE BRACKET ANCHOR SHAFT
- 2 - PIVOT SHAFT
- 3 - ANCHOR SHAFT PLUG

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 212 Remove Guide Bracket Pivot Shaft**

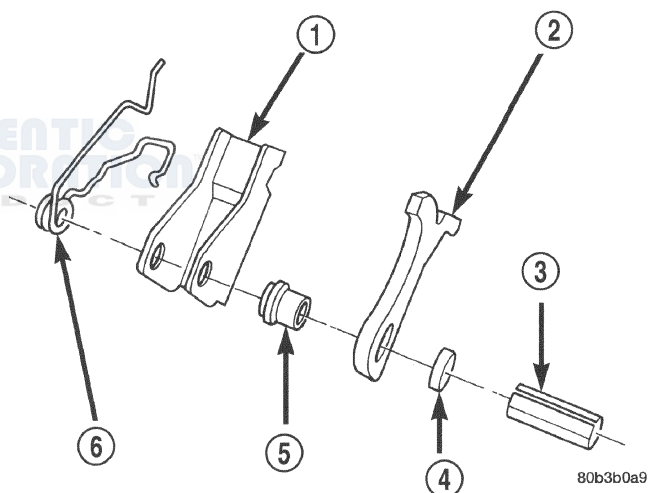
- 1 - GUIDE BRACKET PIVOT SHAFT
- 2 - PLIERS

**Fig. 213 Pivot Shaft and Guide Bracket**

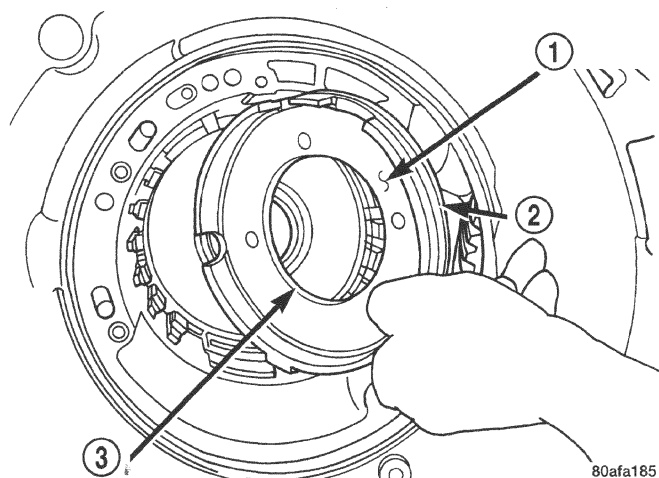
- 1 - ANTIRATCHET SPRING
- 2 - GUIDE BRACKET
- 3 - PIVOT SHAFT
- 4 - PAWL

**Fig. 214 Guide Bracket**

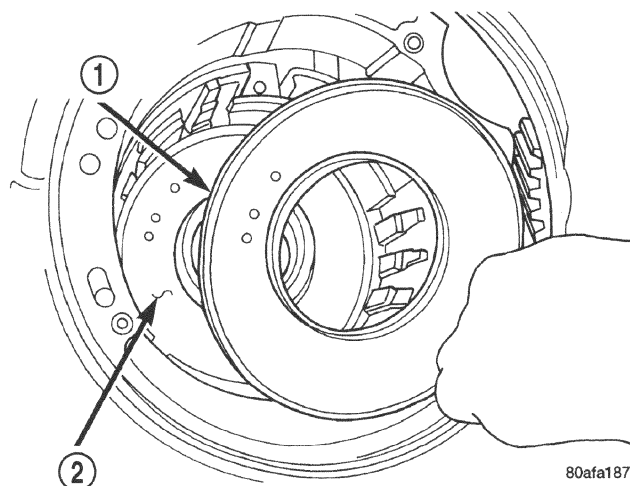
- 1 - GUIDE BRACKET
- 2 - ANTIRATCHET SPRING (MUST BE ASSEMBLED AS SHOWN)
- 3 - PAWL

**Fig. 215 Guide Bracket Disassembled**

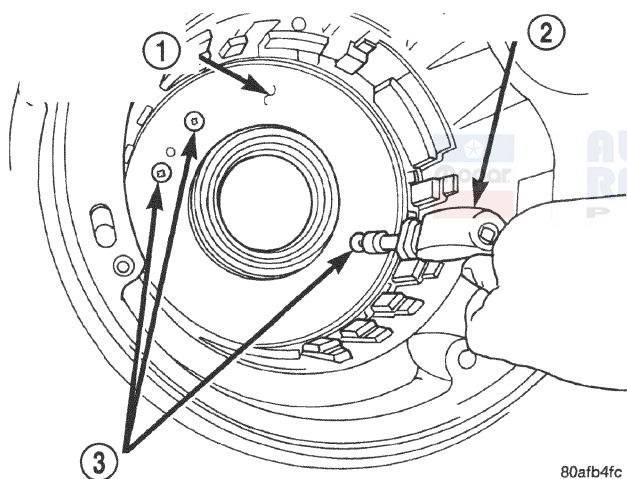
- 1 - GUIDE BRACKET
- 2 - PAWL
- 3 - SPLIT SLEEVE
- 4 - SPACER
- 5 - STEPPED SPACER
- 6 - ANTIRATCHET SPRING

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 216 Remove Low/Reverse Clutch Piston**

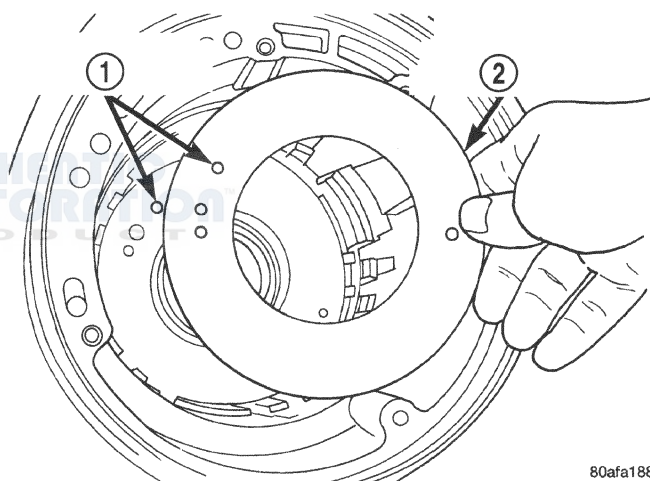
- 1 - LOW/REVERSE CLUTCH PISTON
- 2 - LIP SEAL
- 3 - LIP SEAL

**Fig. 218 Remove Piston Retainer**

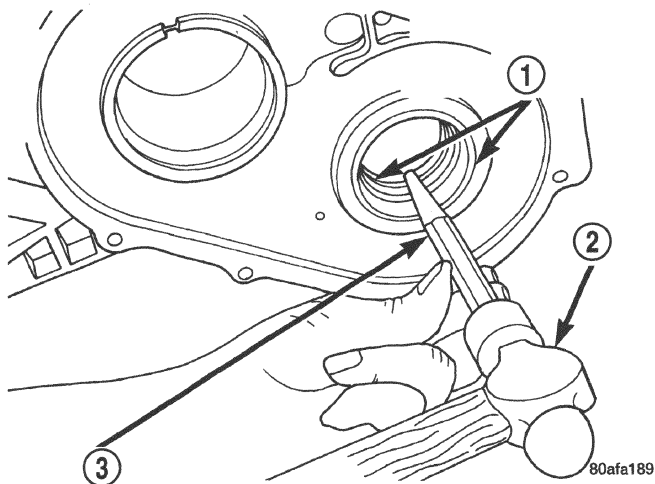
- 1 - LOW/REVERSE CLUTCH PISTON RETAINER
- 2 - GASKET

**Fig. 217 Remove Piston Retainer Attaching Screws**

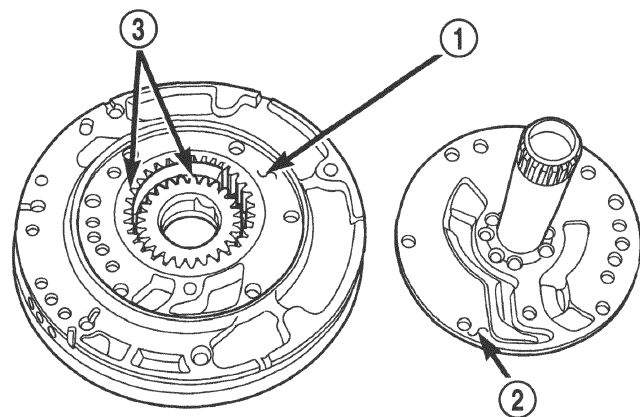
- 1 - LOW/REVERSE CLUTCH PISTON RETAINER
- 2 - SCREWDRIVER
- 3 - TORX-LOC SCREWS

**Fig. 219 Remove Piston Retainer Gasket**

- 1 - GASKET HOLES MUST LINE UP
- 2 - LOW/REVERSE CLUTCH PISTON RETAINER GASKET

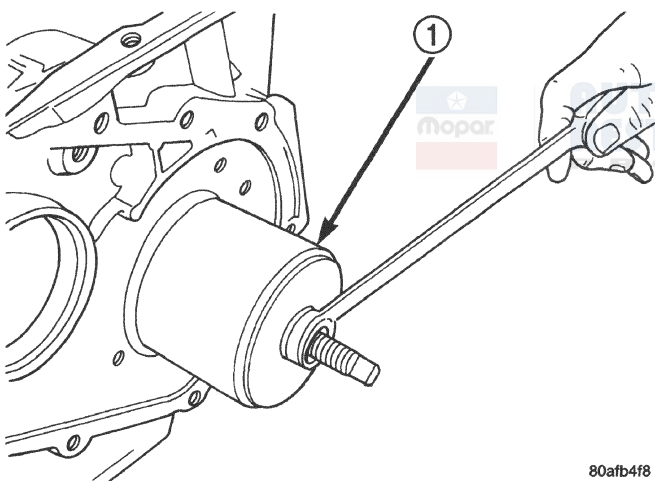
**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 220 Remove Output Bearing Inner Cup**

- 1 - OUTPUT BEARING CUPS (REPLACE IN PAIRS)
- 2 - HAMMER
- 3 - BRASS DRIFT

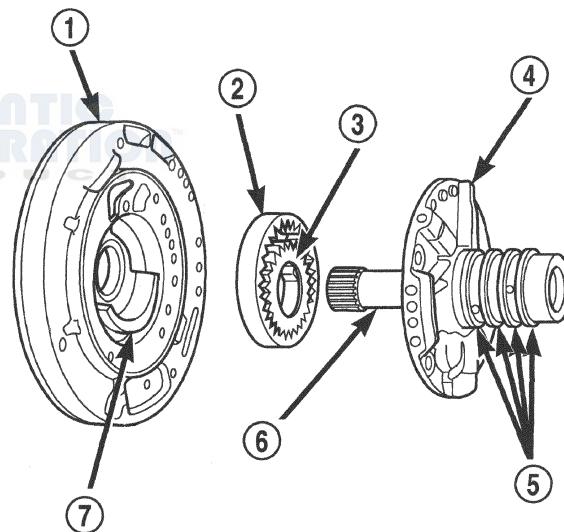
**Fig. 222 Reaction Shaft Support**

- 1 - PUMP HOUSING
- 2 - REACTION SHAFT SUPPORT
- 3 - PUMP GEARS

**CAUTION:** Drift bearing cup all the way around.

**Fig. 221 Remove Output Bearing Outer Cup**

- 1 - TOOL 6062

**Fig. 223 Oil Pump Assembly**

- 1 - PUMP HOUSING
- 2 - OUTER PUMP GEAR
- 3 - INNER PUMP GEAR
- 4 - REACTION SHAFT SUPPORT
- 5 - SEAL RINGS (4)
- 6 - REACTION SHAFT
- 7 - CRESCENT

**OIL PUMP****DISASSEMBLY, INSPECTION, & ASSEMBLY**

When disassembling the transaxle it is necessary to inspect the oil pump for wear and damage.

- (1) Remove the reaction shaft support bolts.
- (2) Remove reaction shaft support from pump housing (Fig. 222).

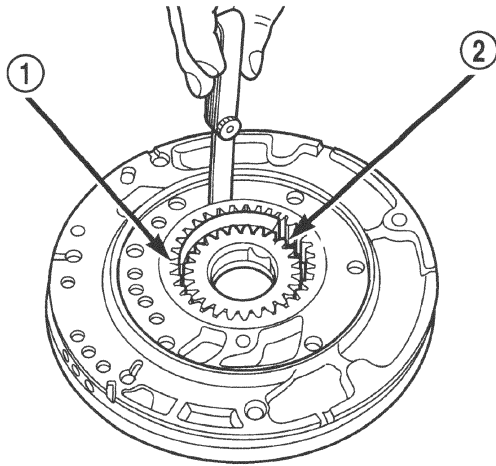
- (3) Remove the pump gears (Fig. 223) and check for wear and damage.



**DISASSEMBLY AND ASSEMBLY (Continued)**

(4) Re-install the gears and check clearances.

(5) Measure the clearance between the outer gear and the pump pocket (Fig. 224). Clearance should be 0.045-0.141mm (0.0018-0.0056 in.).



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**Fig. 224 Measure Outer Gear to Pocket**

- 1 - OUTER GEAR
- 2 - POCKET

(6) Position an appropriate piece of Plastigage across both pump gears.

(7) Align the Plastigage to a flat area on the reaction shaft support housing.

(8) Install the reaction shaft to the pump housing. Tighten the bolts to 27 N·M (20 ft. lbs.).

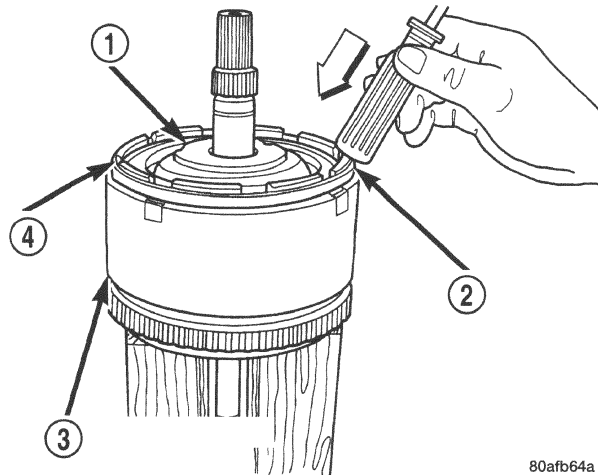
(9) Remove bolts and carefully separate the housings. Measure the Plastigage following the instructions supplied.

(10) Clearance between outer gear side and the reaction shaft support should be 0.020-0.046 mm (0.008-0.0018 in.). Clearance between inner gear side and the reaction shaft support should be 0.020-0.046 mm (0.008-0.0018 in.).

**INPUT CLUTCH ASSEMBLY****DISASSEMBLY**

(1) Mount input clutch assembly to Input Clutch Pressure Fixture (Tool 8391).

(2) Tap down reverse clutch reaction plate to release pressure from snap ring (Fig. 225).

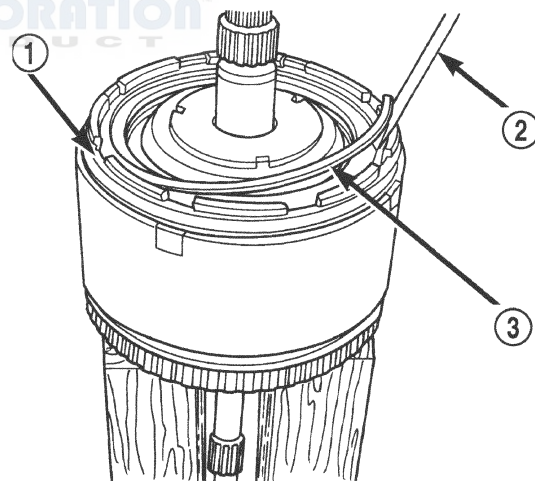


80afb64a

**Fig. 225 Tapping Reaction Plate**

- 1 - #4 THRUST PLATE (SELECT)
- 2 - TAP DOWN REVERSE CLUTCH REACTION PLATE TO REMOVE OR INSTALL SNAP RING
- 3 - INPUT SHAFT CLUTCHES RETAINER ASSEMBLY
- 4 - REVERSE CLUTCH REACTION PLATE

(3) Remove reverse clutch snap ring (Fig. 226).



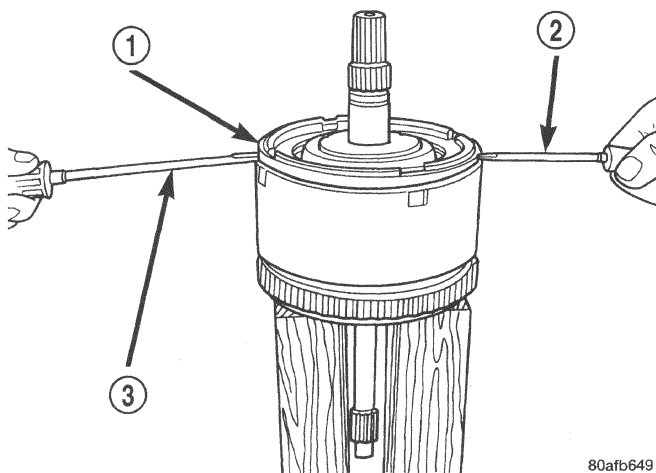
80afb64b

**Fig. 226 Reverse Clutch Snap Ring**

- 1 - REACTION PLATE
- 2 - SCREWDRIVER
- 3 - REVERSE CLUTCH SNAP RING (SELECT)

**DISASSEMBLY AND ASSEMBLY (Continued)**

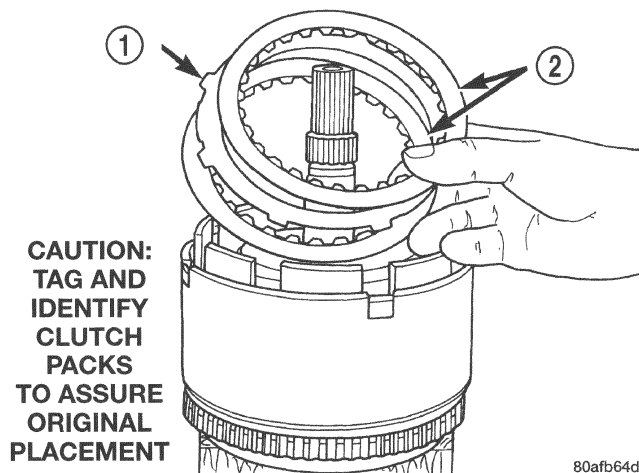
(4) Pry up and remove reverse clutch reaction plate (Fig. 227) (Fig. 228).



**Fig. 227 Pry Reverse Clutch Reaction Plate**

- 1 - REVERSE CLUTCH REACTION PLATE
- 2 - SCREWDRIVER
- 3 - SCREWDRIVER

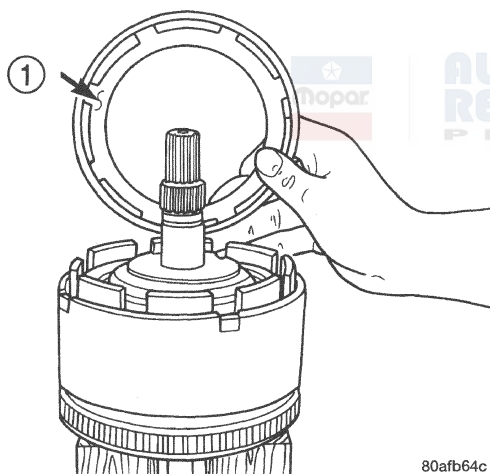
**NOTE:** Tag reverse clutch pack for reassembly identification.



**Fig. 229 Reverse Clutch Pack**

- 1 - REVERSE CLUTCH PLATE
- 2 - REVERSE CLUTCH DISC

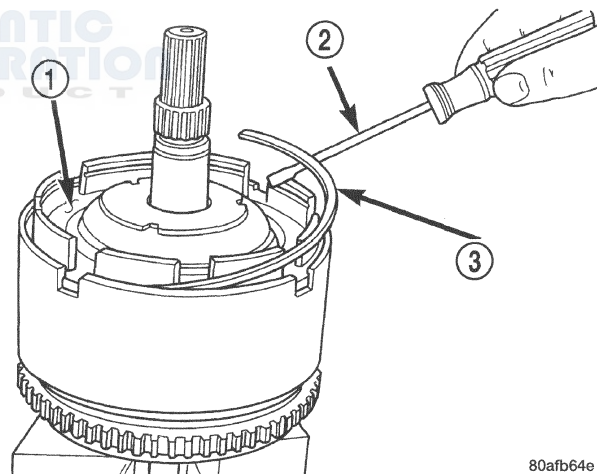
(6) Remove the OD/Reverse reaction plate snap ring (Fig. 230).



**Fig. 228 Reverse Clutch Reaction Plate**

- 1 - REVERSE CLUTCH REACTION PLATE (INSTALL FLAT SIDE DOWN)

(5) Remove the reverse clutch pack (two fibers/one steel) (Fig. 229).

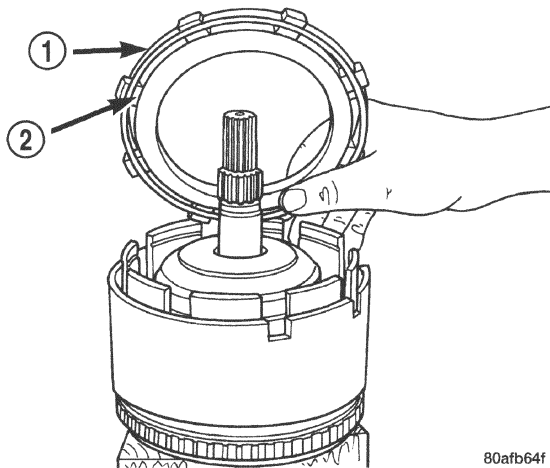


**Fig. 230 OD/Reverse Reaction Plate Snap Ring**

- 1 - OD/REVERSE PRESSURE PLATE
- 2 - SCREWDRIVER
- 3 - OD/REVERSE PRESSURE PLATE SNAP RING

**DISASSEMBLY AND ASSEMBLY (Continued)**

(7) Remove OD/Reverse reaction plate (Fig. 231).

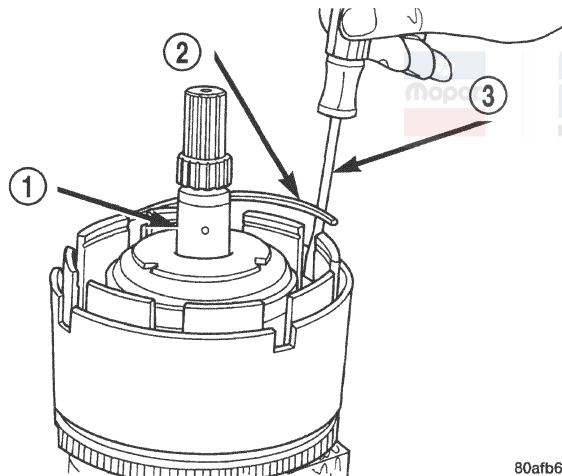


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**Fig. 231 OD/Reverse Reaction Plate**

- 1 - OD/REVERSE PRESSURE PLATE (STEP SIDE DOWN)
- 2 - (STEP SIDE DOWN)

(8) Remove OD/Reverse reaction plate wave snap ring (Fig. 232).



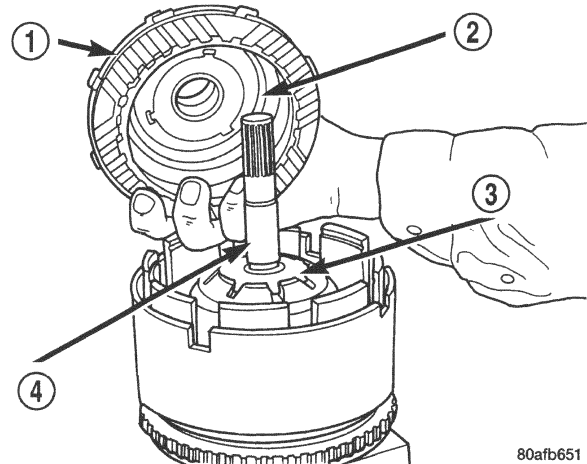
80afb650

**Fig. 232 Waved Snap Ring**

- 1 - OVERDRIVE SHAFT ASSEMBLY
- 2 - OD/REVERSE CLUTCH WAVED SNAP RING
- 3 - SCREWDRIVER

(9) Remove OD shaft/hub and OD clutch pack (Fig. 233) (Fig. 234).

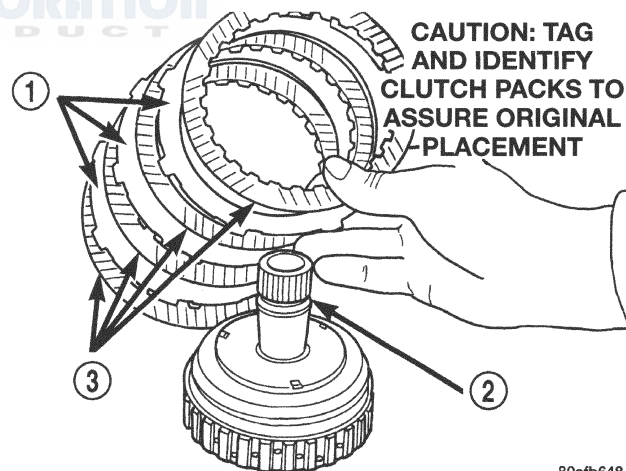
**NOTE: Tag overdrive clutch pack for reassembly identification.**



80afb651

**Fig. 233 Remove OD Clutch Pack**

- 1 - OVERDRIVE SHAFT ASSEMBLY AND OD CLUTCH PACK
- 2 - #3 THRUST PLATE
- 3 - #3 THRUST WASHER
- 4 - UNDERDRIVE SHAFT ASSEMBLY



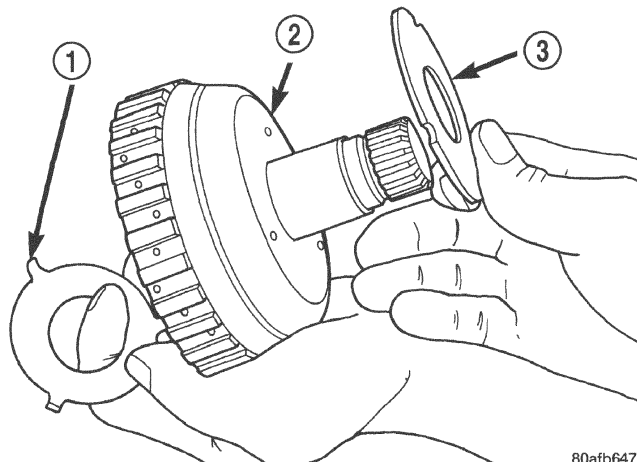
80afb648

**Fig. 234 Overdrive Clutch Pack**

- 1 - OVERDRIVE CLUTCH PLATE
- 2 - OVERDRIVE SHAFT ASSEMBLY
- 3 - OVERDRIVE CLUTCH DISC

**DISASSEMBLY AND ASSEMBLY (Continued)**

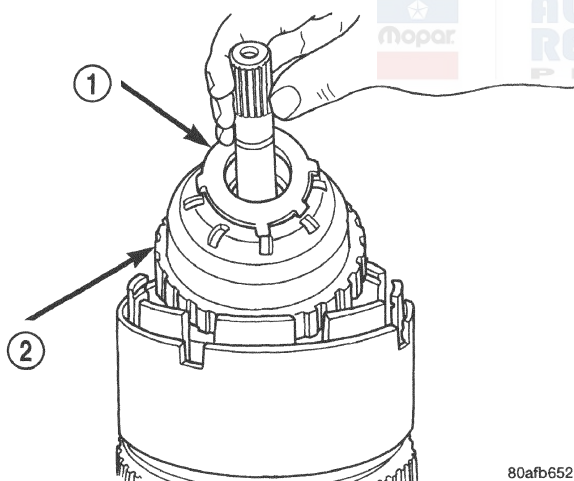
(10) Remove and inspect #3 & #4 thrust washers (Fig. 235).



**Fig. 235 #3&4 Thrust Washers**

- 1 - #3 THRUST PLATE (3 TABS)
- 2 - OD SHAFT ASSEMBLY
- 3 - #4 THRUST PLATE (3 SLOTS)

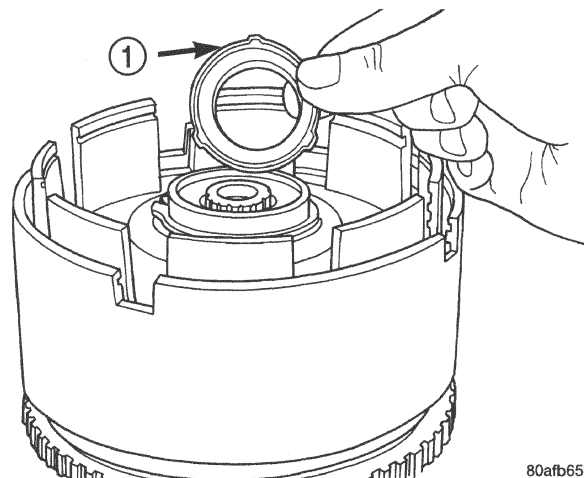
(11) Remove the underdrive shaft assembly (Fig. 236).



**Fig. 236 Underdrive Shaft Assembly**

- 1 - #3 THRUST WASHER (5 TABS)
- 2 - UNDERDRIVE SHAFT ASSEMBLY

(12) Remove the #2 needle bearing (Fig. 237).

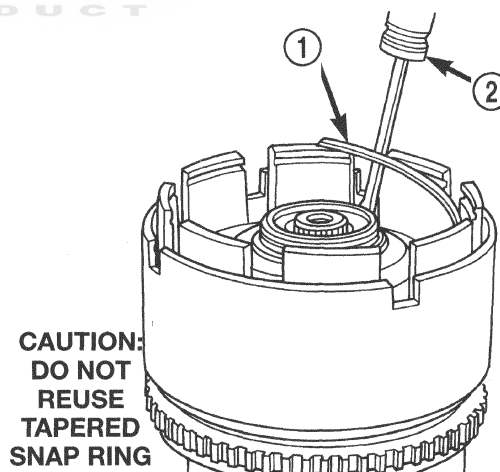


**Fig. 237 No. 2 Needle Bearing**

- 1 - #2 NEEDLE BEARING (NOTE 3 TABS)

**NOTE:** The OD/UD Reaction Plate, Snap Rings, and Input Clutches Retainer is not interchangeable with previous year 41TE components. The snap rings are thicker and the position of the ring lands have changed.

(13) Remove the OD/UD reaction plate tapered snap ring (Fig. 238).



**CAUTION:**  
DO NOT  
REUSE  
TAPERED  
SNAP RING

**Fig. 238 OD/UD Reaction Plate Tapered Snap Ring**

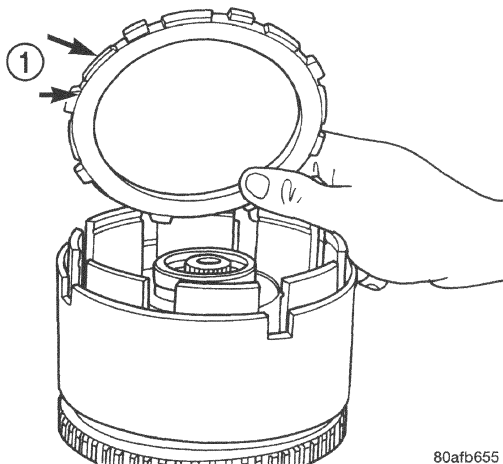
- 1 - OVERDRIVE/UNDERDRIVE CLUTCHES REACTION PLATE TAPERED SNAP RING
- 2 - SCREWDRIVER (DO NOT SCRATCH REACTION PLATE)



**DISASSEMBLY AND ASSEMBLY (Continued)**

**NOTE:** The OD/UD clutch reaction plate has a step on both sides. Install the OD/UD clutches reaction plate tapered step side up.

(14) Remove the OD/UD reaction plate (Fig. 239).

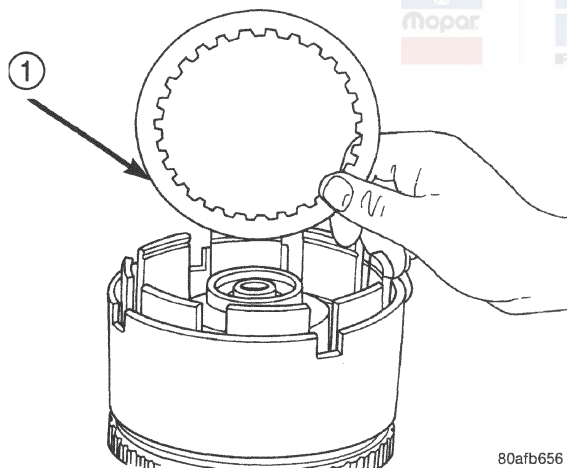


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**Fig. 239 OD/UD Reaction Plate**

1 - OD/UD CLUTCH REACTION PLATE (STEP SIDE DOWN)

(15) Remove the first UD clutch disc (Fig. 240).

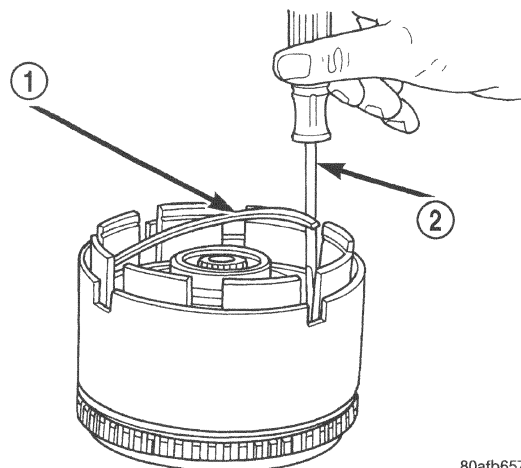


80afb656

**Fig. 240 Remove One UD Clutch Disc**

1 - ONE UNDERDRIVE CLUTCH DISC

(16) Remove the UD clutch flat snap ring (Fig. 241).



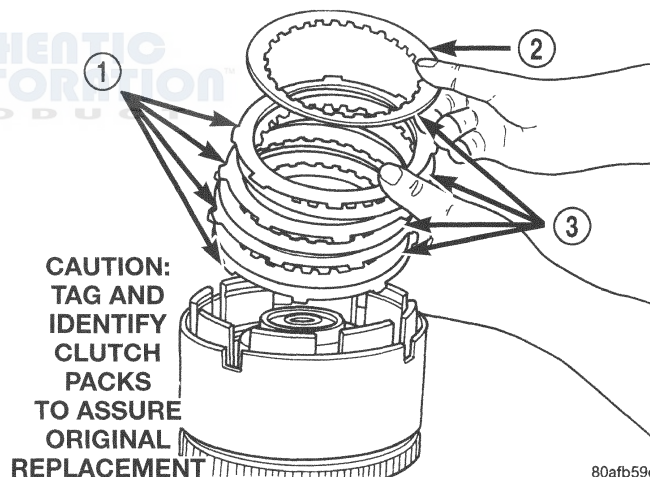
80afb657

**Fig. 241 UD Clutch Flat Snap Ring**

1 - UNDERDRIVE CLUTCH REACTION PLATE FLAT SNAP RING  
2 - SCREWDRIVER

**NOTE:** Tag underdrive clutch pack for reassembly identification.

(17) Remove the UD clutch pack (Fig. 242).



80afb59e

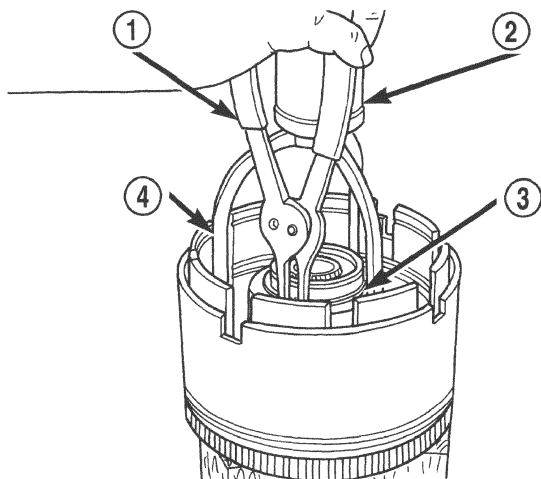
**Fig. 242 Underdrive Clutch Pack**

1 - CLUTCH PLATE  
2 - ONE UD CLUTCH DISC  
3 - CLUTCH DISC

**CAUTION:** Compress return spring just enough to remove or install snap ring.

**DISASSEMBLY AND ASSEMBLY (Continued)**

(18) Using Tool 5059A and an arbor press, compress UD clutch piston enough to remove snap ring (Fig. 243) (Fig. 244).

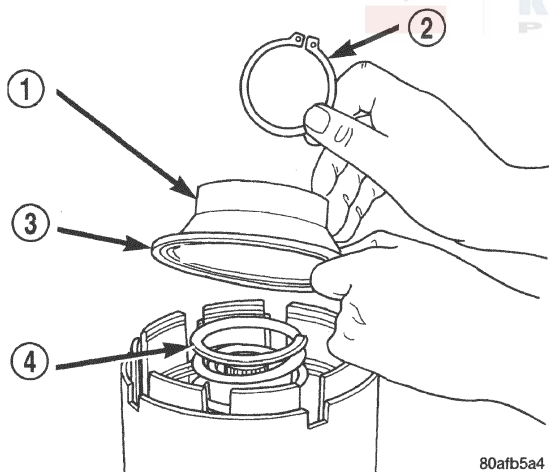


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**Fig. 243 UD Spring Retainer Snap Ring**

- 1 - SNAP RING PLIERS
- 2 - ARBOR PRESS RAM
- 3 - SNAP RING
- 4 - SPECIAL TOOL 5059A

(19) Remove spring retainer (Fig. 244).

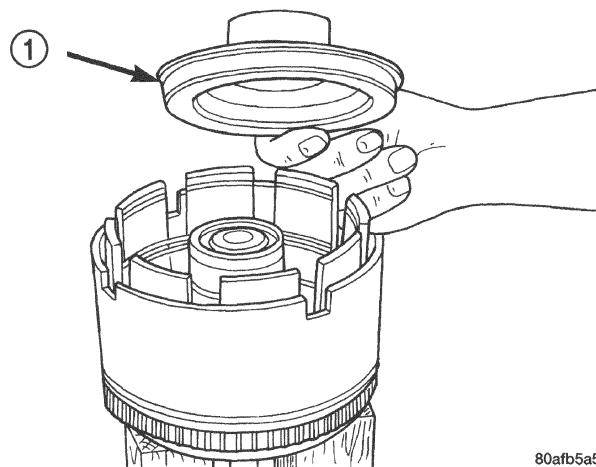


80afb5a4

**Fig. 244 UD Return Spring and Retainer**

- 1 - UNDERDRIVE SPRING RETAINER
- 2 - SNAP RING
- 3 - SEAL
- 4 - PISTON RETURN SPRING

(20) Remove UD clutch piston (Fig. 245).

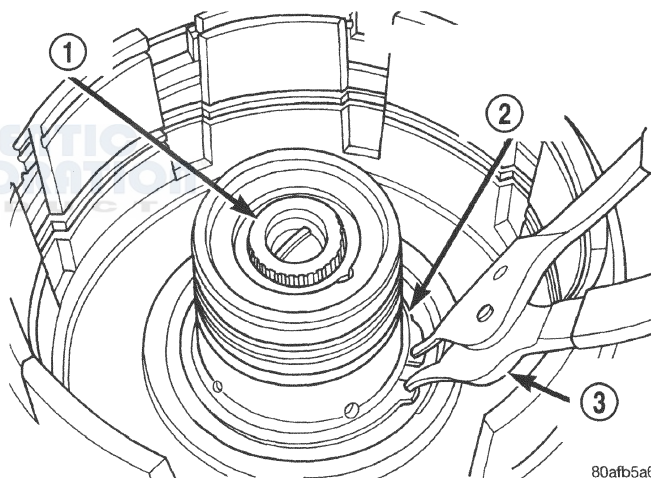


80afb5a5

**Fig. 245 Underdrive Clutch Piston**

- 1 - PISTON

(21) Remove input hub tapered snap ring (Fig. 246).

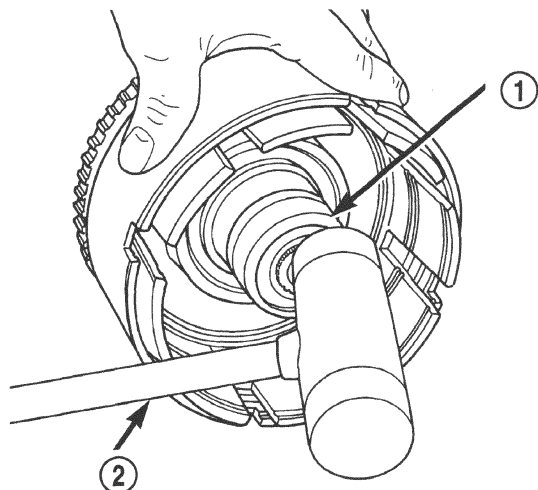


80afb5a6

**Fig. 246 Input Hub Tapered Snap Ring**

- 1 - INPUT SHAFT
- 2 - INPUT HUB SNAP RING (TAPERED SIDE UP WITH TABS IN CAVITY)
- 3 - SNAP RING PLIERS

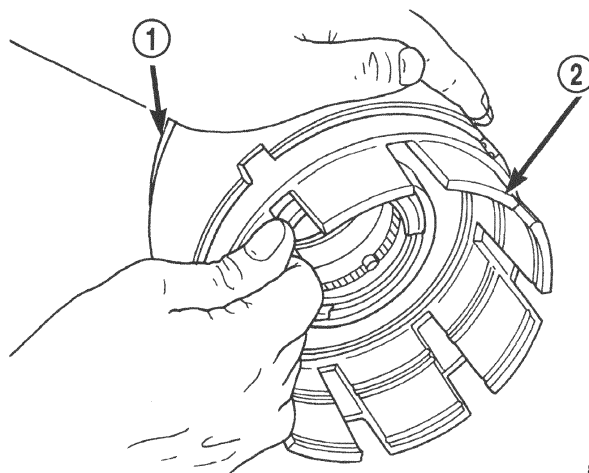
(22) Tap on input hub with soft faced hammer and separate input hub from OD/Reverse piston and clutch retainer (Fig. 247) (Fig. 248).

**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 247 Tap on Input Hub**

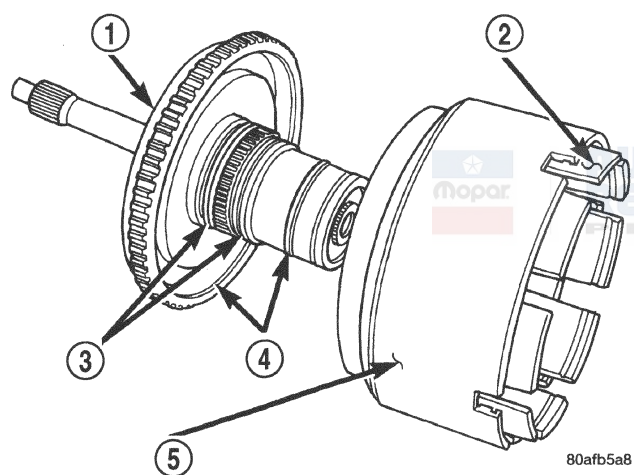
- 1 - INPUT SHAFT AND HUB ASSEMBLY
- 2 - PLASTIC HAMMER



80afb5a9

**Fig. 249 Pull Retainer from Piston**

- 1 - OVERDRIVE/REVERSE PISTON
- 2 - INPUT CLUTCHES RETAINER



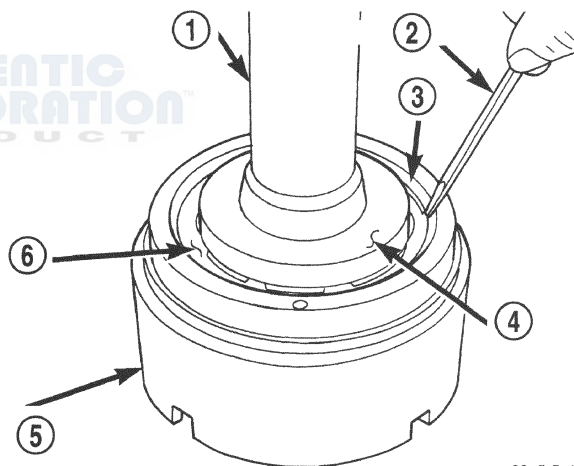
80afb5a8

**Fig. 248 Input Hub Removed**

- 1 - INPUT SHAFT AND HUB ASSEMBLY
- 2 - INPUT CLUTCHES RETAINER
- 3 - O-RING
- 4 - SEAL
- 5 - OVERDRIVE/REVERSE PISTON

(23) Separate clutch retainer from OD/Reverse piston (Fig. 249).

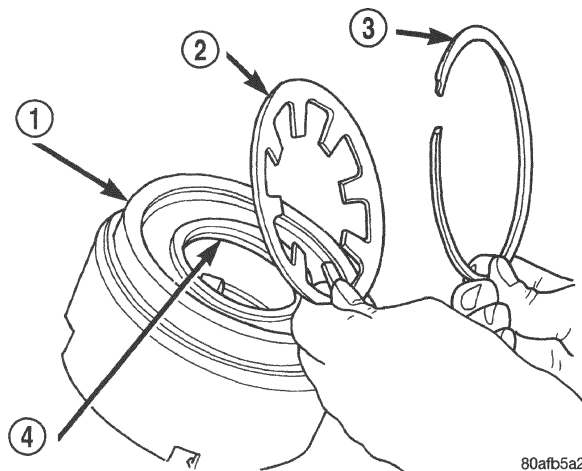
(24) Using Tool 6057 and an arbor press, compress return OD/Reverse piston return spring just enough to remove snap ring (Fig. 250) (Fig. 251).



80afb5a1

**Fig. 250 Remove Snap Ring**

- 1 - ARBOR PRESS RAM (COMPRESS RETURN SPRING JUST ENOUGH TO REMOVE OR INSTALL SNAP RING)
- 2 - SCREWDRIVER
- 3 - SNAP RING
- 4 - SPECIAL TOOL 6057
- 5 - OD/REVERSE PISTON
- 6 - RETURN SPRING

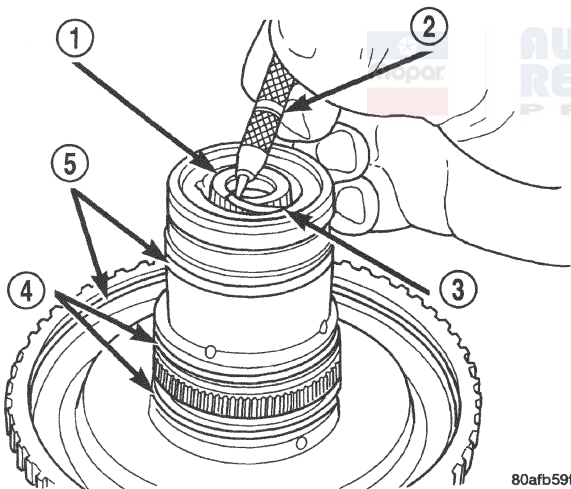
**DISASSEMBLY AND ASSEMBLY (Continued)**

80afb5a2

**Fig. 251 Snap Ring and Return Spring**

- 1 - OD/REVERSE PISTON
- 2 - RETURN SPRING
- 3 - SNAP RING
- 4 - O-RING

(25) Remove input shaft to input clutch hub snap ring (Fig. 252).

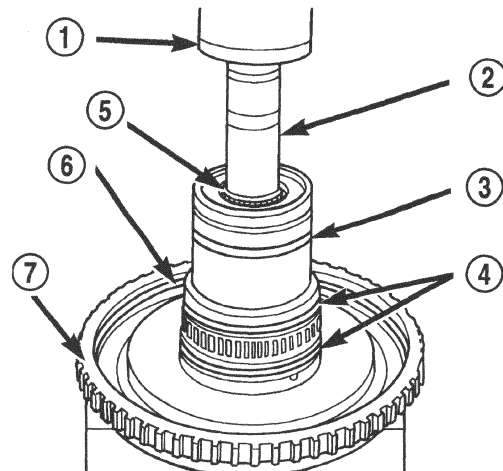


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**Fig. 252 Remove Input Shaft Snap Ring**

- 1 - INPUT SHAFT
- 2 - SHARP-POINTED TOOL
- 3 - SNAP RING
- 4 - O-RINGS
- 5 - SEALS

(26) Using a suitably sized socket and an arbor press, remove input shaft from input shaft hub (Fig. 253).



80afb5a0

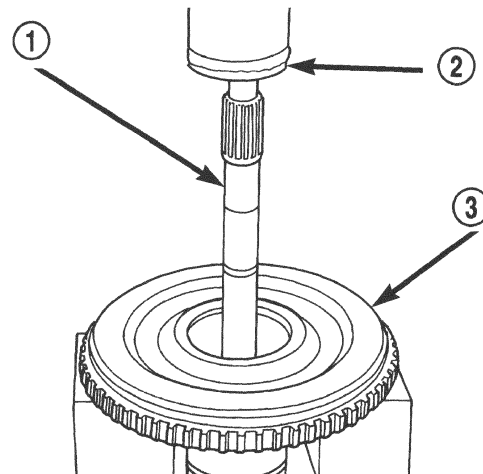
**Fig. 253 Remove Input Shaft**

- 1 - ARBOR PRESS RAM
- 2 - SOCKET
- 3 - SEAL
- 4 - O-RINGS
- 5 - INPUT SHAFT
- 6 - SEAL
- 7 - INPUT SHAFT HUB ASSEMBLY

**ASSEMBLY**

Use petrolatum on all seals to ease assembly of components.

(1) Using an arbor press, install input shaft to input shaft hub (Fig. 254).



80afb5aa

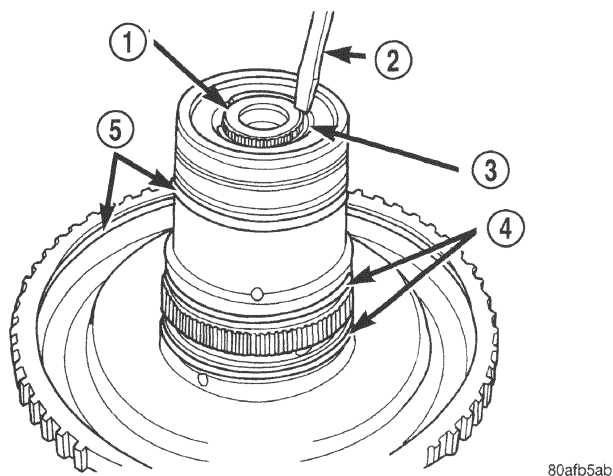
**Fig. 254 Install Input Shaft**

- 1 - INPUT SHAFT
- 2 - ARBOR PRESS RAM
- 3 - INPUT SHAFT HUB ASSEMBLY



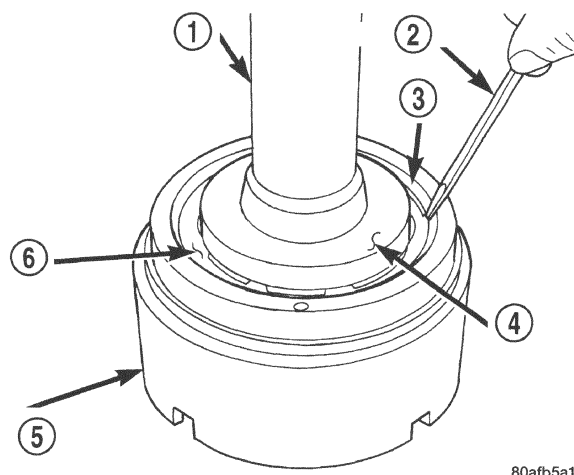
**DISASSEMBLY AND ASSEMBLY (Continued)**

(2) Install input shaft snap ring (Fig. 255).



**Fig. 255 Install Input Shaft Snap Ring**

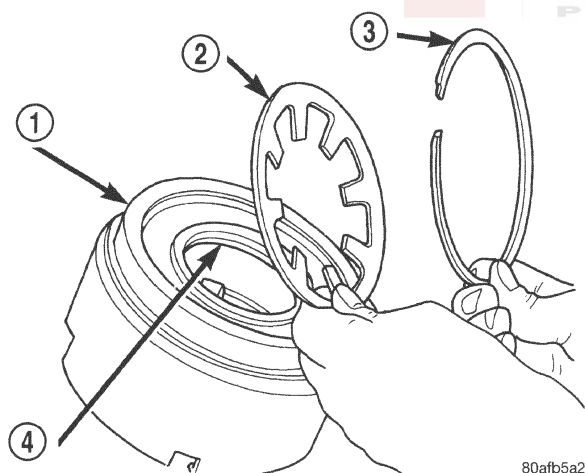
- 1 - INPUT SHAFT
- 2 - SCREWDRIVER (DO NOT SCRATCH BEARING SURFACE)
- 3 - SNAP RING
- 4 - O-RINGS
- 5 - SEALS



**Fig. 257 Install Snap Ring**

- 1 - ARBOR PRESS RAM (COMPRESS RETURN SPRING JUST ENOUGH TO REMOVE OR INSTALL SNAP RING)
- 2 - SCREWDRIVER
- 3 - SNAP RING
- 4 - SPECIAL TOOL 6057
- 5 - OD/REVERSE PISTON
- 6 - RETURN SPRING

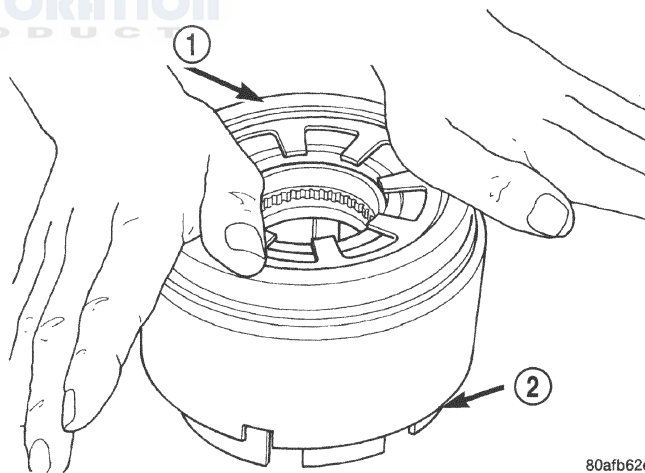
(3) Using an arbor press and Tool 6057, Install OD/Reverse piston return spring and snap ring (Fig. 256) (Fig. 257).



**Fig. 256 Return Spring and Snap Ring**

- 1 - OD/REVERSE PISTON
- 2 - RETURN SPRING
- 3 - SNAP RING
- 4 - O-RING

(4) Install the OD/Reverse piston assembly to the input clutch retainer as shown in (Fig. 258).



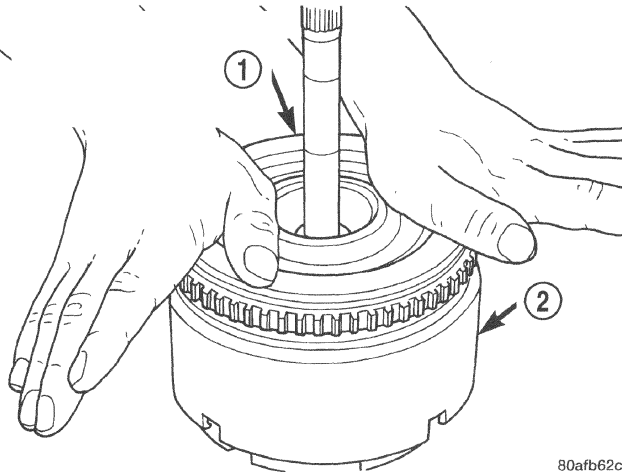
**Fig. 258 Install OD/Reverse Piston**

- 1 - PUSH DOWN TO INSTALL OVERDRIVE/REVERSE PISTON
- 2 - INPUT CLUTCHES RETAINER

## DISASSEMBLY AND ASSEMBLY (Continued)

**NOTE:** The OD/UD Reaction Plate, Snap Rings, and Input Clutches Retainer is not interchangeable with previous year 41TE components. The snap rings are thicker and the position of the ring lands have changed.

(5) Install the input hub/shaft assy. to the OD/Reverse piston/clutch retainer assy. (Fig. 259).

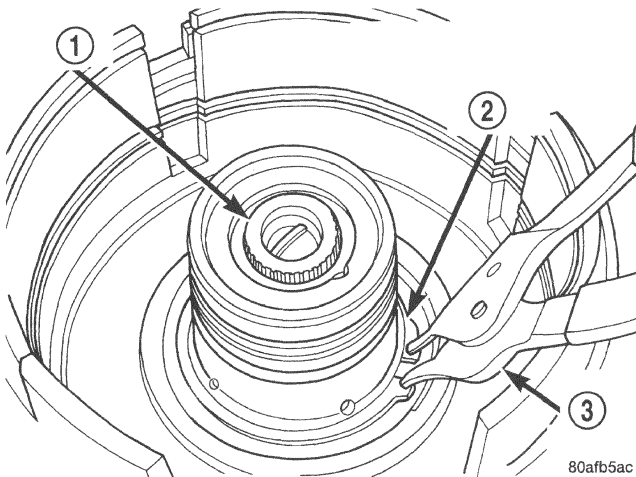


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**Fig. 259 Install Input Shaft Hub Assembly**

- 1 - PUSH DOWN TO INSTALL INPUT SHAFT HUB ASSEMBLY (ROTATE TO ALIGN SPLINES)
- 2 - OD/REV. PISTON

(6) Install input hub tapered snap ring (Fig. 260).

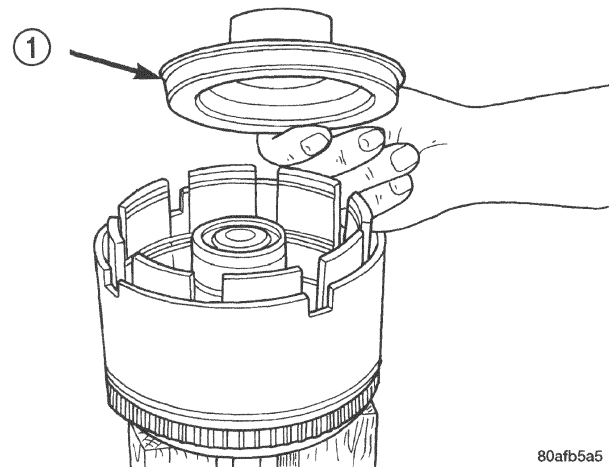


80afb5ac

**Fig. 260 Install Input Hub Tapered Snap Ring**

- 1 - INPUT SHAFT
- 2 - INPUT HUB SNAP RING (TAPERED SIDE UP WITH TABS IN CAVITY)
- 3 - SNAP RING PLIERS

(7) Install UD clutch piston (Fig. 261).

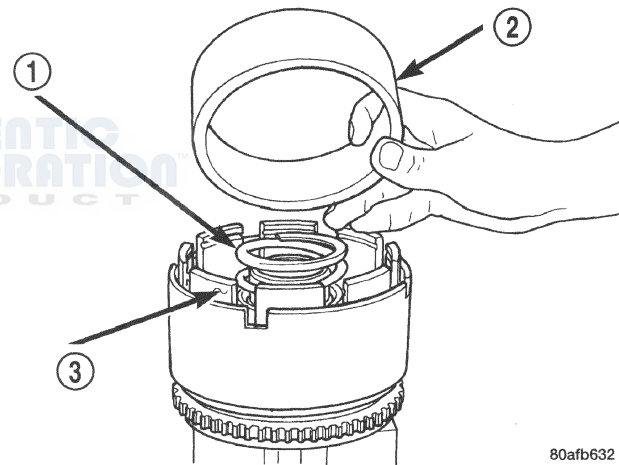


80afb5a5

**Fig. 261 Underdrive Clutch Piston**

- 1 - PISTON

(8) Install UD piston return spring and Tool 5067 as shown in (Fig. 262).



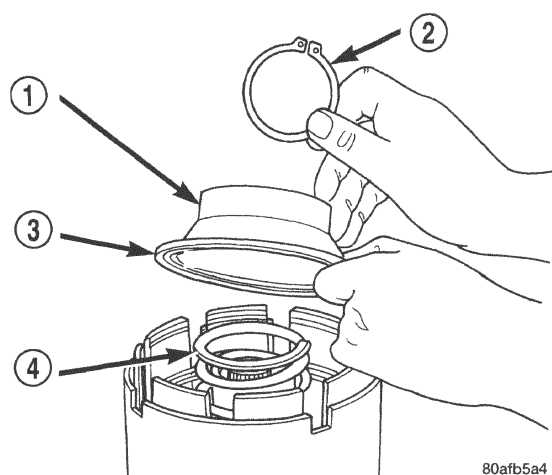
80afb632

**Fig. 262 Seal Compressor Special Tool 5067**

- 1 - PISTON RETURN SPRING
- 2 - SPECIAL TOOL 5067
- 3 - INPUT SHAFT CLUTCHES RETAINER ASSEMBLY

(9) Using Tool 5059A and an arbor press, Install the UD spring retainer and snap ring. (Fig. 263) (Fig. 264) Compress just enough to install snap ring.

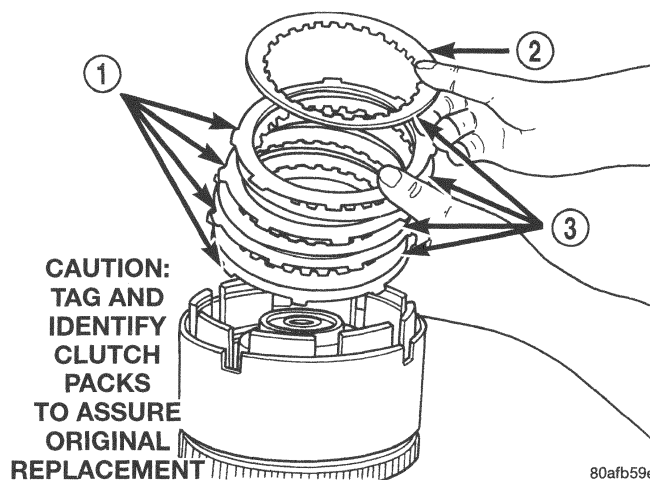
**CAUTION:** Compress return spring just enough to install snap ring.

**DISASSEMBLY AND ASSEMBLY (Continued)**

80afb5a4

**Fig. 263 UD Return Spring and Retainer**

- 1 - UNDERDRIVE SPRING RETAINER
- 2 - SNAP RING
- 3 - SEAL
- 4 - PISTON RETURN SPRING



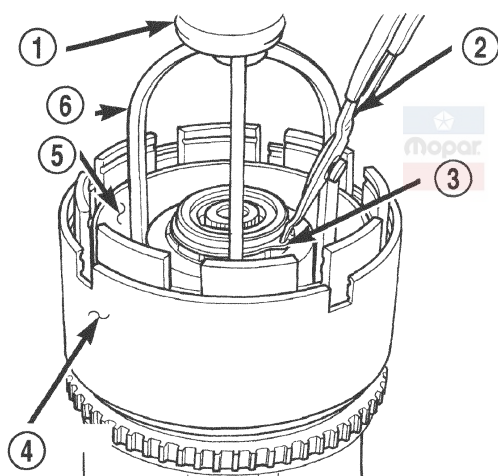
80afb59e

**CAUTION:**  
TAG AND  
IDENTIFY  
CLUTCH  
PACKS  
TO ASSURE  
ORIGINAL  
REPLACEMENT

**Fig. 265 Underdrive Clutch Pack**

- 1 - CLUTCH PLATE
- 2 - ONE UD CLUTCH DISC
- 3 - CLUTCH DISC

(11) Install the UD clutch flat snap ring (Fig. 266).

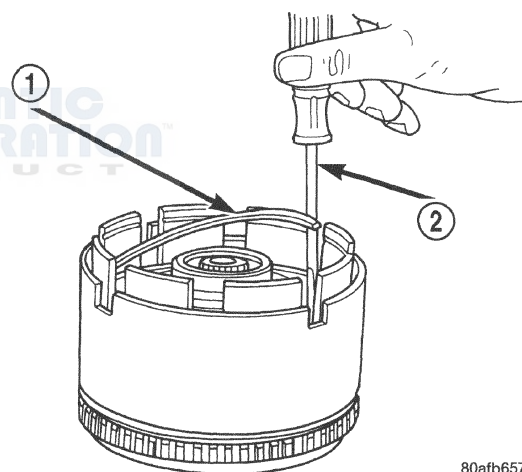


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**Fig. 264 Install UD Spring Retainer and Snap Ring**

- 1 - ARBOR PRESS RAM
- 2 - SNAP RING PLIERS
- 3 - SNAP RING
- 4 - OD/REVERSE PISTON
- 5 - TOOL 5067
- 6 - TOOL 5059A

(10) Install the UD clutch pack (four fibers/four steels) (Fig. 265).

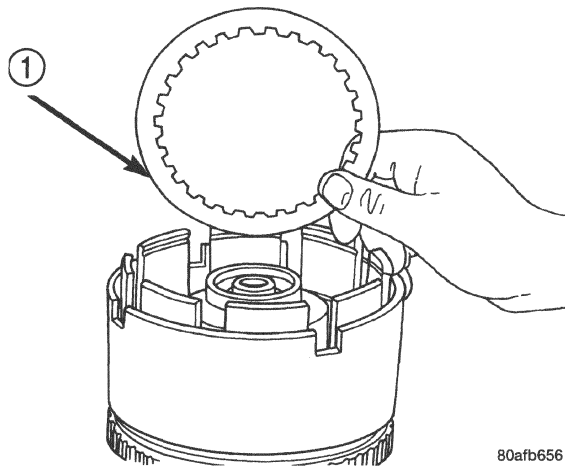


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**Fig. 266 UD Clutch Flat Snap Ring**

- 1 - UNDERDRIVE CLUTCH REACTION PLATE FLAT SNAP RING
- 2 - SCREWDRIVER

(12) Install the last UD clutch disc (Fig. 267).

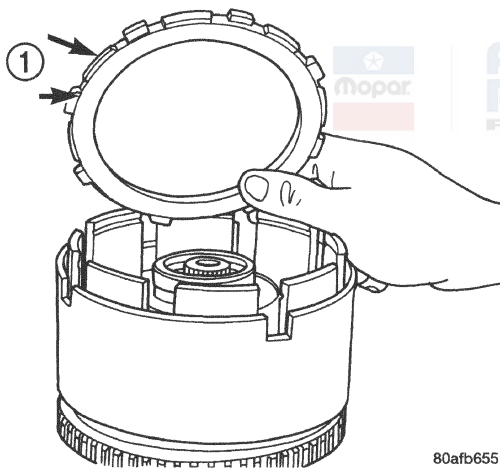
**DISASSEMBLY AND ASSEMBLY (Continued)**

80afb656

**Fig. 267 Install Last UD Clutch Disc**

1 - ONE UNDERDRIVE CLUTCH DISC

(13) Install the OD/UD clutch reaction plate and snap ring (Fig. 268) (Fig. 269). The OD/UD clutches reaction plate has a step on both sides. Install the OD/UD clutches reaction plate tapered step side up.

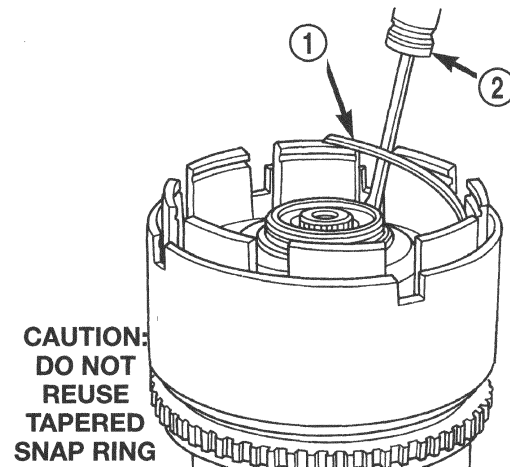


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**Fig. 268 OD/UD Reaction Plate**

1 - OD/UD CLUTCH REACTION PLATE (STEP SIDE DOWN)

**NOTE:** Snap ring ends must be located within one finger of the input clutch hub. Be sure that snap ring is fully seated, by pushing with screwdriver, into snap ring groove all the way around.

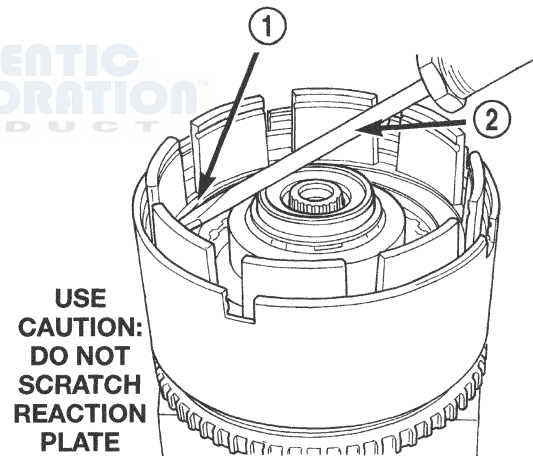


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**Fig. 269 Tapered Snap Ring**

1 - OVERDRIVE/UNDERDRIVE CLUTCHES REACTION PLATE TAPERED SNAP RING  
2 - SCREWDRIVER (DO NOT SCRATCH REACTION PLATE)

(14) Seat tapered snap ring to ensure proper installation (Fig. 270).



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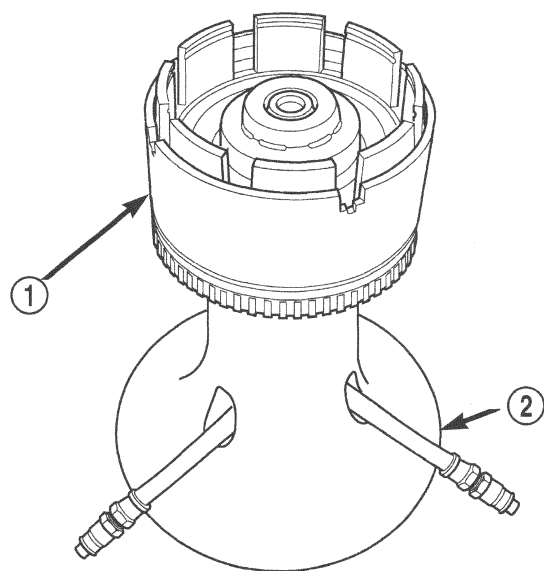
**Fig. 270 Seating Tapered Snap Ring**

1 - OVERDRIVE/UNDERDRIVE CLUTCHES REACTION PLATE TAPERED SNAP RING  
2 - SCREWDRIVER

(15) Install input clutch assembly to the Input Clutch Pressure Fixture—Tool 8391 (Fig. 271).



## DISASSEMBLY AND ASSEMBLY (Continued)

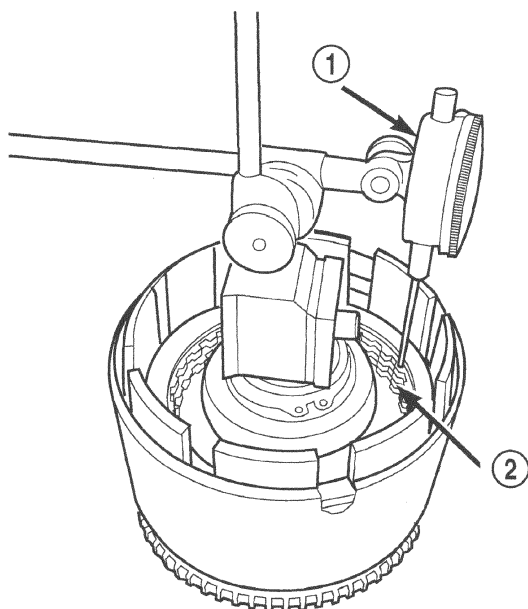


80c07260

**Fig. 271 Input Clutch Assembly on Pressure Fixture Tool 8391**

- 1 - INPUT CLUTCH ASSEMBLY  
2 - INPUT CLUTCH PRESSURE FIXTURE 8391

(16) Set up dial indicator on the UD clutch pack as shown in (Fig. 272).

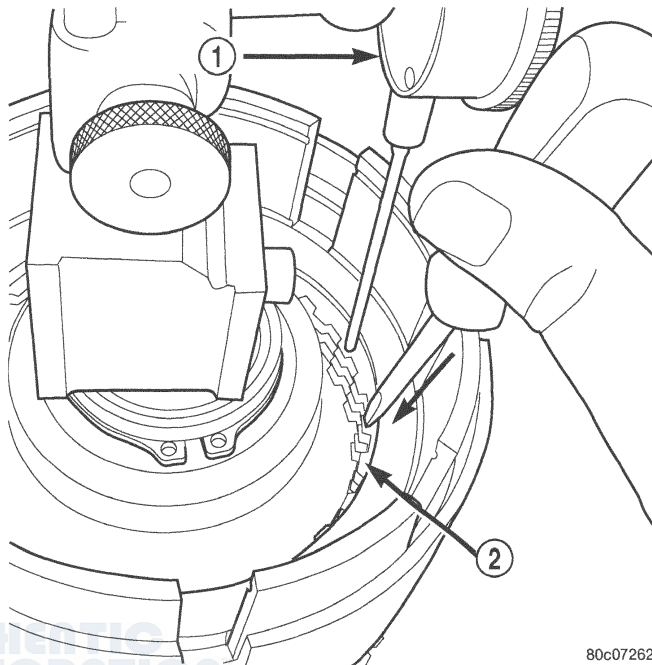


80c07261

**Fig. 272 Set Up Dial Indicator to Measure UD Clutch Clearance**

- 1 - DIAL INDICATOR  
2 - UNDERDRIVE CLUTCH

(17) Using moderate pressure, press down and hold (near indicator) the UD clutch pack with screwdriver or suitable tool and zero dial indicator (Fig. 273). When releasing pressure on clutch pack, indicator reading should advance 0.005–0.010.



80c07262

**Fig. 273 Press Down on UD Clutch Pack and Zero Dial Indicator**

- 1 - DIAL INDICATOR  
2 - UNDERDRIVE CLUTCH

**CAUTION:** Do not apply more than 30 psi (206 kPa) to the underdrive clutch pack.

(18) Apply 30 psi (206 kPa) to the underdrive hose on Tool 8391 and measure UD clutch clearance. Measure and record UD clutch pack measurement in four (4) places, 90° apart.

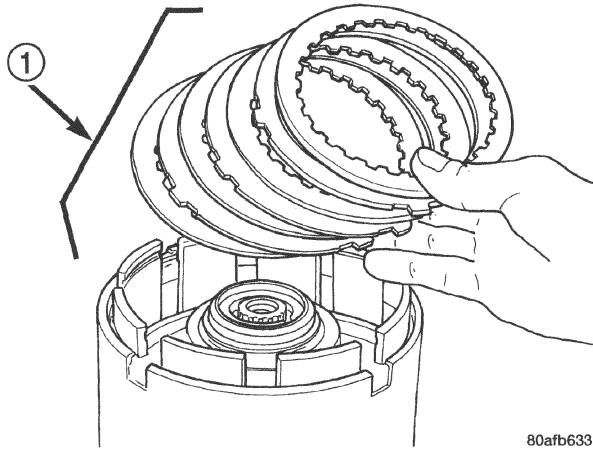
(19) Take average of four measurements and compare with UD clutch pack clearance specification. **Underdrive clutch pack clearance must be 0.94–1.50 mm (0.037–0.059 in.).**

(20) If necessary, select the proper reaction plate to achieve specifications:

UNDERDRIVE REACTION PLATE THICKNESS	
4659939AB	5.837-5.937 mm (0.230-0.234 in.)
4659940AB	6.147-6.248 mm (0.242-0.246 in.)
4659941AB	6.457-6.557 mm (0.254-0.258 in.)

**DISASSEMBLY AND ASSEMBLY (Continued)**

(21) Install the OD clutch pack (four fibers/four steels) (Fig. 274).

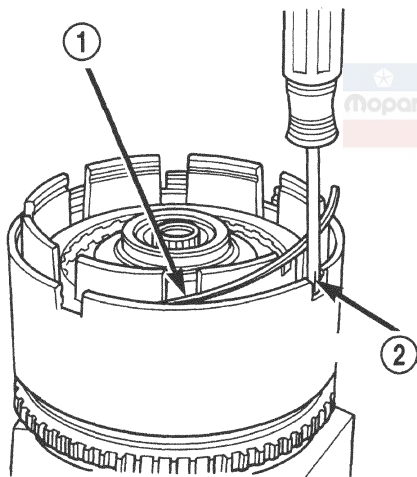


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**Fig. 274 Install OD Clutch Pack**

1 - OVERDRIVE CLUTCH PACK

(22) Install OD reaction plate waved snap ring (Fig. 275).

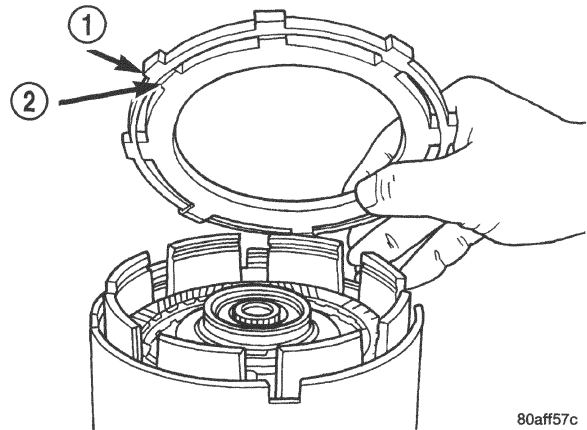


80aff57b

**Fig. 275 Install Waved Snap Ring**

1 - OVERDRIVE REACTION PLATE WAVED SNAP RING  
2 - SCREWDRIVER

(23) Install the OD/Reverse reaction plate with large step down (towards OD clutch pack) (Fig. 276).

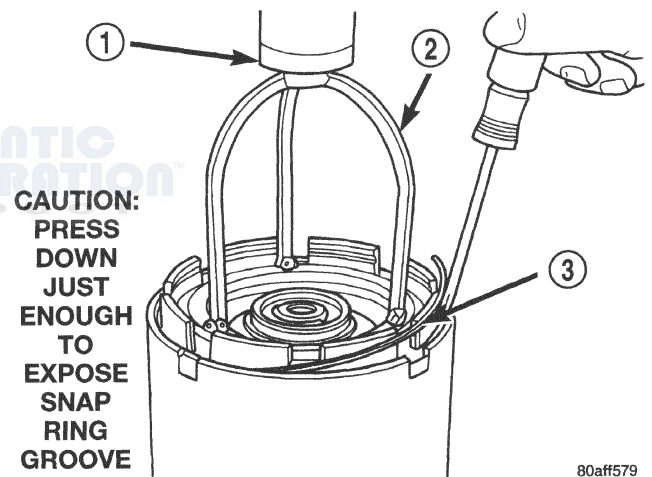


80aff57c

**Fig. 276 OD/Reverse Reaction Plate**

1 - OVERDRIVE/REVERSE PRESSURE PLATE  
2 - (STEP SIDE DOWN)

(24) Install OD reaction plate flat snap ring (Fig. 277).

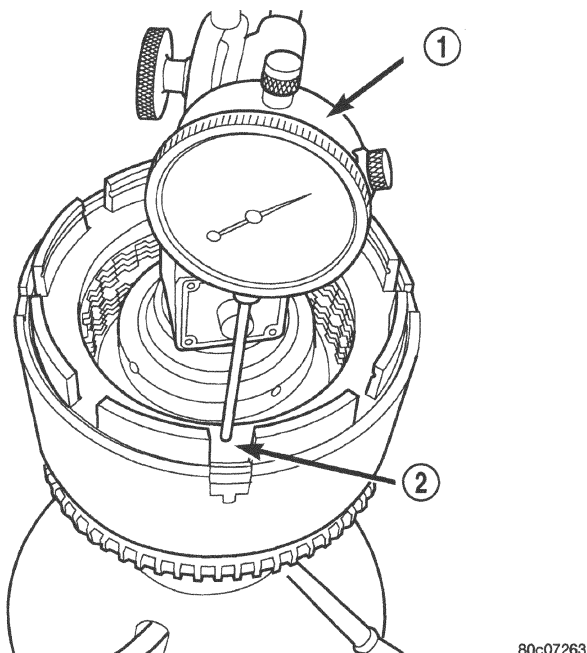


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**Fig. 277 Install Flat Snap Ring**

1 - ARBOR PRESS RAM  
2 - TOOL 5059A  
3 - FLAT SNAP RING

(25) Measure OD clutch pack clearance. Set up dial indicator on top of the OD/Reverse reaction plate as shown in (Fig. 278).

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 278 Measure OD Clutch Pack Clearance**

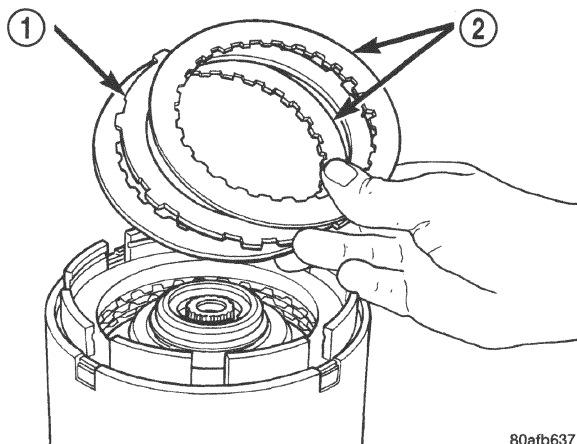
- 1 - DIAL INDICATOR  
2 - OD/REVERSE REACTION PLATE

(26) Zero dial indicator and apply 30 psi (206 kPa) air pressure to the overdrive clutch hose on Tool 8391. Measure and record OD clutch pack measurement in four (4) places, 90° apart.

(27) Take average of four measurements and compare with OD clutch pack clearance specification. **The overdrive (OD) clutch pack clearance is 1.07-3.25 mm (0.042-0.128 in.).**

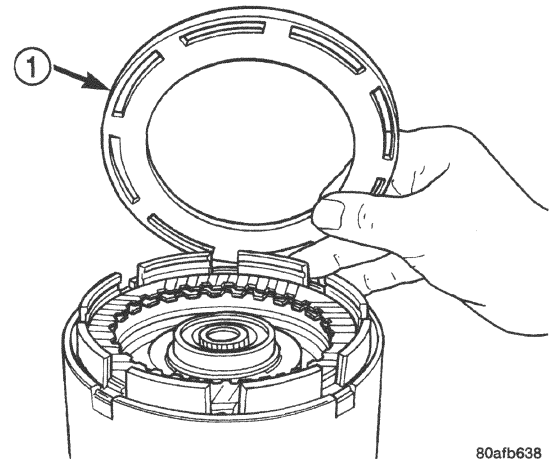
If not within specifications, the clutch is not assembled properly. There is no adjustment for the OD clutch clearance.

(28) Install reverse clutch pack (two fibers/one steel) (Fig. 279).

**Fig. 279 Install Reverse Clutch Pack**

- 1 - REVERSE CLUTCH PLATE  
2 - REVERSE CLUTCH DISCS

(29) Install reverse clutch reaction plate with the flat side down towards reverse clutch (Fig. 280).

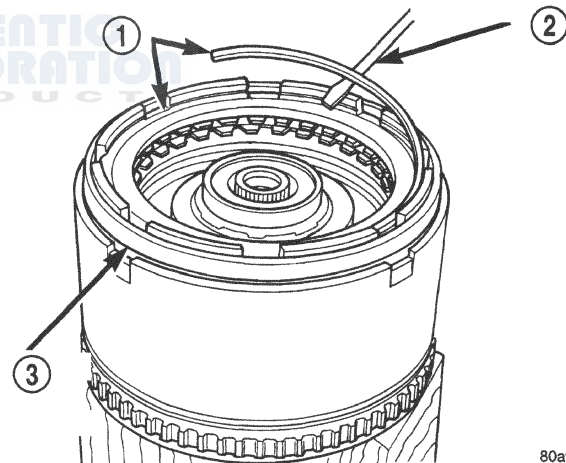


80afb638

**Fig. 280 Install Reaction Plate**

- 1 - REVERSE CLUTCH REACTION PLATE (FLAT SIDE DOWN)

(30) Tap reaction plate down to allow installation of the reverse clutch snap ring. Install reverse clutch snap ring (Fig. 281).



80afb639

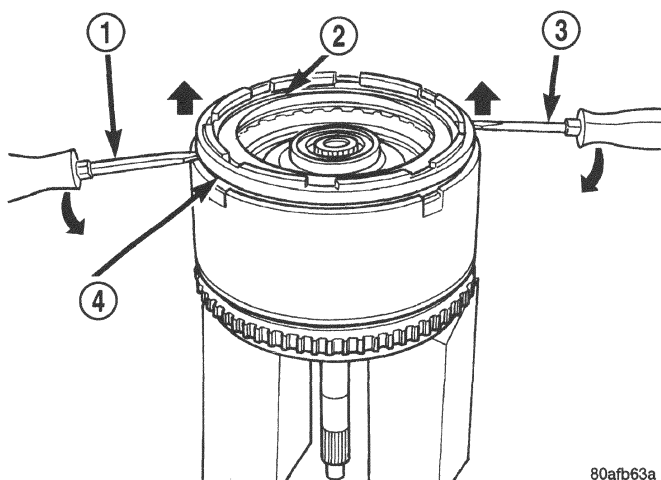
**Fig. 281 Install Reverse Clutch Snap Ring**

- 1 - REVERSE CLUTCH SNAP RING (SELECT)  
2 - SCREWDRIVER  
3 - REVERSE CLUTCH REACTION PLATE

(31) Pry up reverse reaction plate to seat against snap ring (Fig. 282).



## DISASSEMBLY AND ASSEMBLY (Continued)

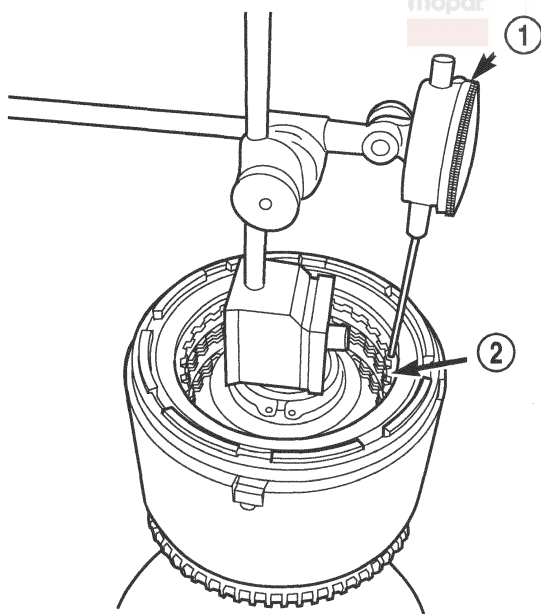


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**Fig. 282 Pry Up Reaction Plate to Seat Against Snap Ring**

- 1 - SCREWDRIVER
- 2 - SNAP RING
- 3 - SCREWDRIVER
- 4 - MUST RAISE REVERSE REACTION PLATE TO RAISE SNAP RING

(32) Set up a dial indicator on the reverse clutch pack as shown in (Fig. 283).

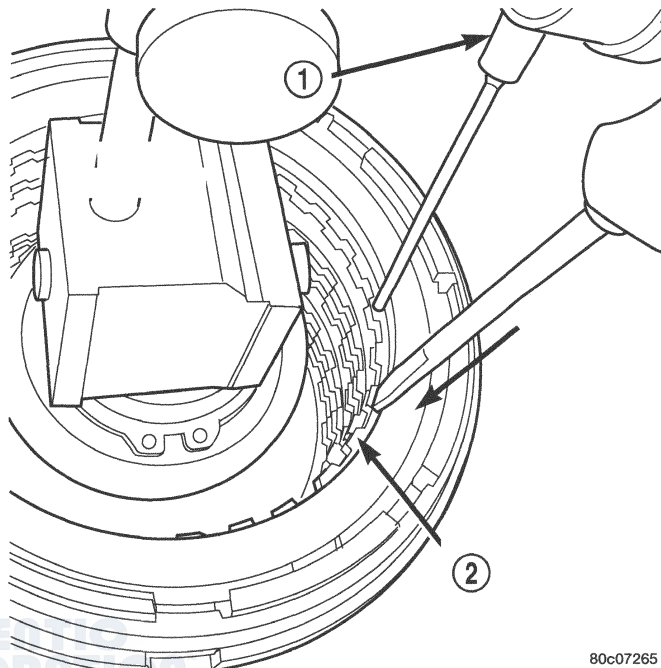


80c07264

**Fig. 283 Measure Reverse Clutch Pack Clearance**

- 1 - DIAL INDICATOR
- 2 - REVERSE CLUTCH

(33) Using moderate pressure, press down and hold (near indicator) reverse clutch disc with screwdriver or suitable tool and zero dial indicator (Fig. 284). When releasing pressure, indicator should advance 0.005-0.010. as clutch pack relaxes.



80c07265

**Fig. 284 Press Down on Reverse Clutch and Zero Indicator**

- 1 - DIAL INDICATOR
- 2 - REVERSE CLUTCH

(34) Apply 30 psi (206 kPa) air pressure to the reverse clutch hose on Tool 8391. Measure and record reverse clutch pack measurement in four (4) places, 90° apart.

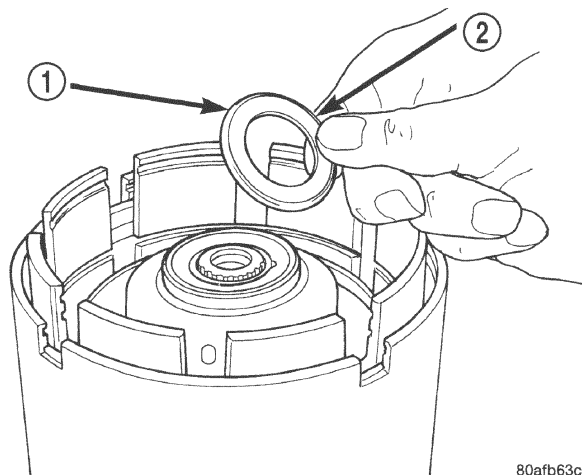
(35) Take average of four measurements and compare with reverse clutch pack clearance specification. **The reverse clutch pack clearance is 0.89-1.37 mm (0.035-0.054 in.).** Select the proper reverse clutch snap ring to achieve specifications:

REVERSE CLUTCH SNAP RING THICKNESS	
4377195	1.53-1.58 mm (0.060-0.062 in.)
4412871	1.77-1.83 mm (0.070-0.072 in.)
4412872	2.02-2.07 mm (0.080-0.082 in.)
4412873	2.27-2.32 mm (0.090-0.091 in.)

(36) To complete the assembly, reverse clutch and overdrive clutch must be removed.

(37) Install the #2 needle bearing (Fig. 285).



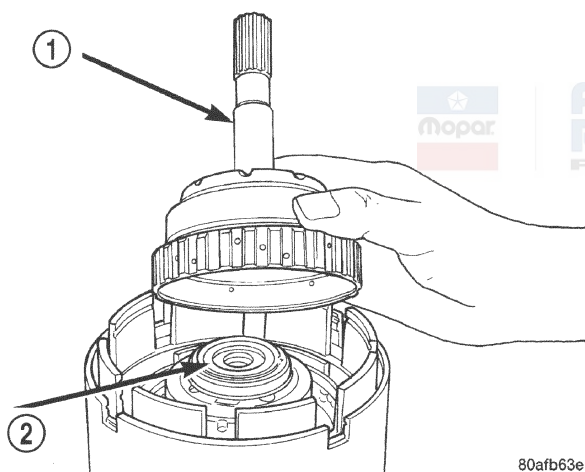
**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 285 Install No. 2 Needle Bearing**

- 1 - #2 NEEDLE BEARING (NOTE 3 SMALL TABS)  
2 - TABS UP

(38) Install the underdrive shaft assembly (Fig. 286).

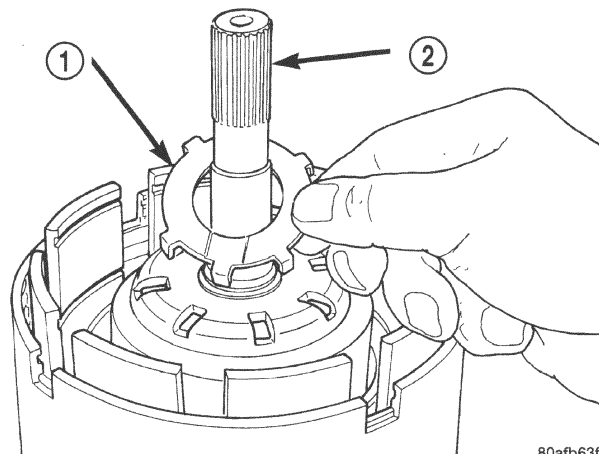


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**Fig. 286 Install Underdrive Shaft Assembly**

- 1 - UNDERDRIVE SHAFT ASSEMBLY  
2 - #2 NEEDLE BEARING

(39) Install the #3 thrust washer to the underdrive shaft assembly. Be sure five tabs are seated properly (Fig. 287).

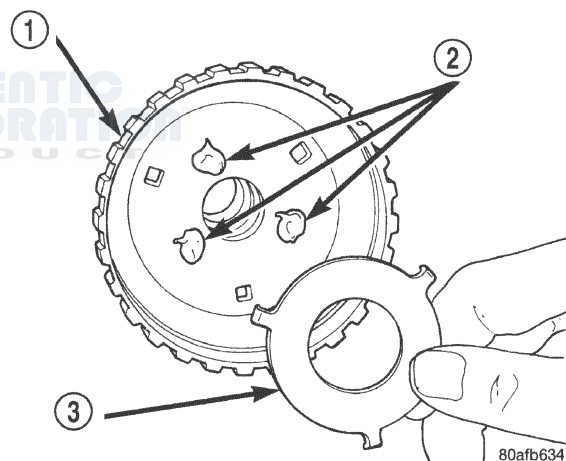


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**Fig. 287 Install No. 3 Thrust Washer**

- 1 - #3 THRUST WASHER (NOTE 5 TABS)  
2 - UNDERDRIVE SHAFT ASSEMBLY

(40) Install the #3 thrust plate to the bottom of the overdrive shaft assembly. Retain with petrolatum or transmission assembly gel (Fig. 288).

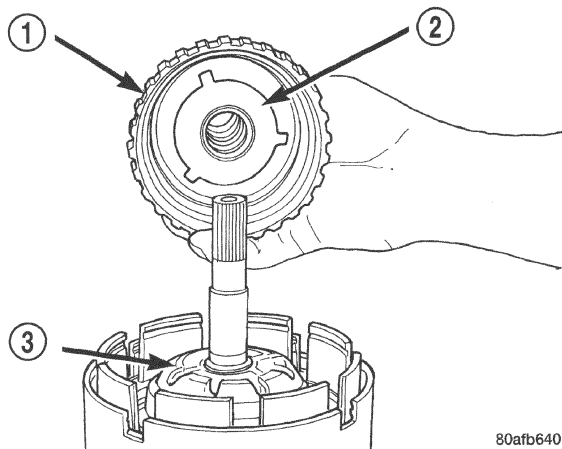


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**Fig. 288 Install No. 3 Thrust Plate**

- 1 - OVERDRIVE SHAFT ASSEMBLY  
2 - DABS OF PETROLATUM (FOR RETENTION)  
3 - #3 THRUST PLATE (NOTE 3 TABS)

(41) Install the overdrive shaft assembly (Fig. 289).

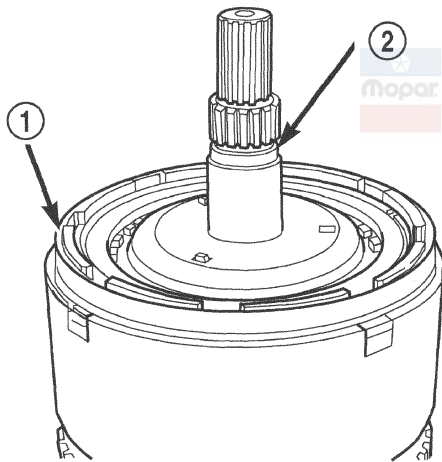
**DISASSEMBLY AND ASSEMBLY (Continued)**

80afb640

**Fig. 289 Install Overdrive Shaft Assembly**

- 1 - OVERDRIVE SHAFT ASSEMBLY
- 2 - #3 THRUST PLATE
- 3 - #3 THRUST WASHER

(42) Reinstall overdrive and reverse clutch as shown. **Rechecking these clutch clearances is not necessary.**



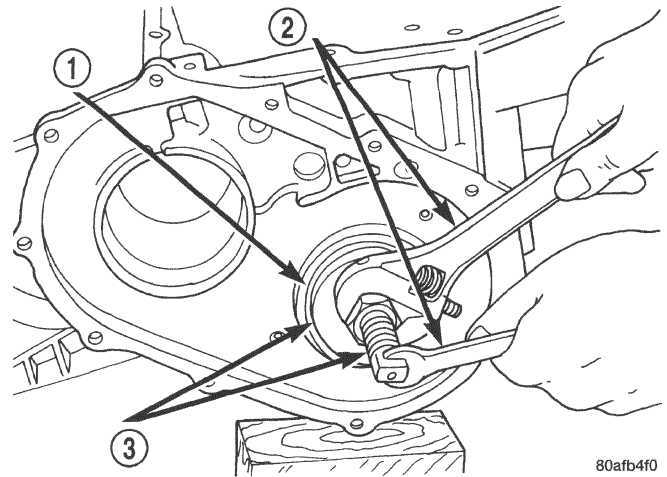
80afb641

**Fig. 290 Input Clutch Assembly**

- 1 - INPUT CLUTCH ASSEMBLY
- 2 - OVERDRIVE SHAFT ASSEMBLY

**TRANSAXLE—ASSEMBLY**

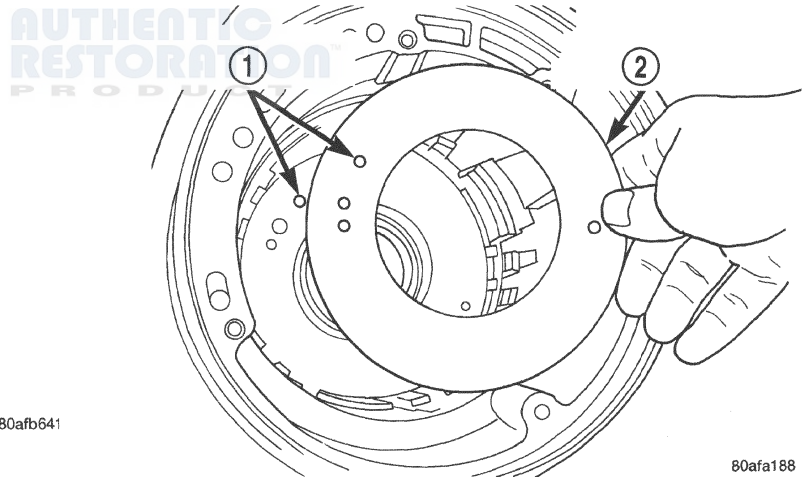
To assemble the transaxle centerline, refer to the following procedures.



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**Fig. 291 Install Both Output Bearing Cups**

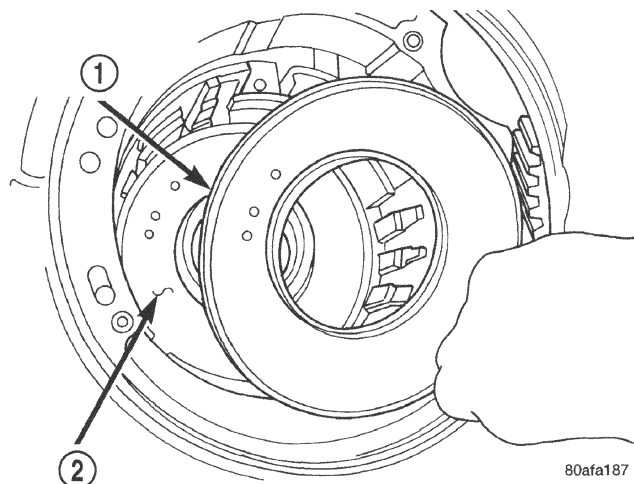
- 1 - OUTPUT BEARING CUPS
- 2 - WRENCHES
- 3 - TOOL 5050



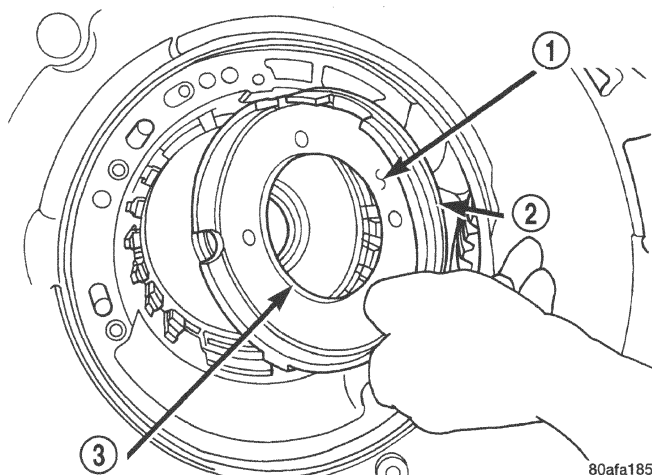
80afa188

**Fig. 292 Install Piston Retainer Gasket**

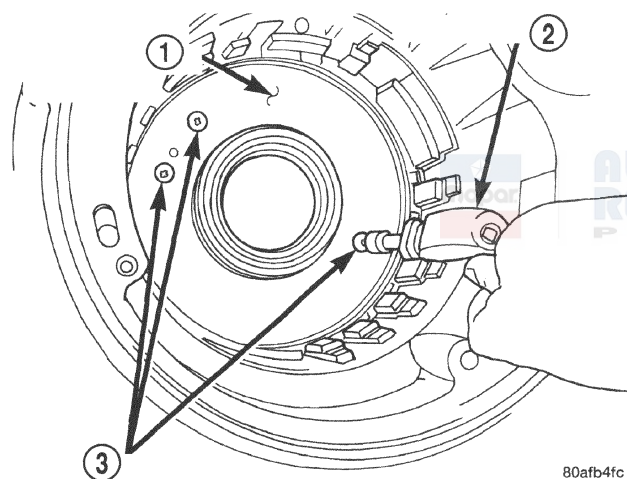
- 1 - GASKET HOLES MUST LINE UP
- 2 - LOW/REVERSE CLUTCH PISTON RETAINER GASKET

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 293 Install Piston Retainer**

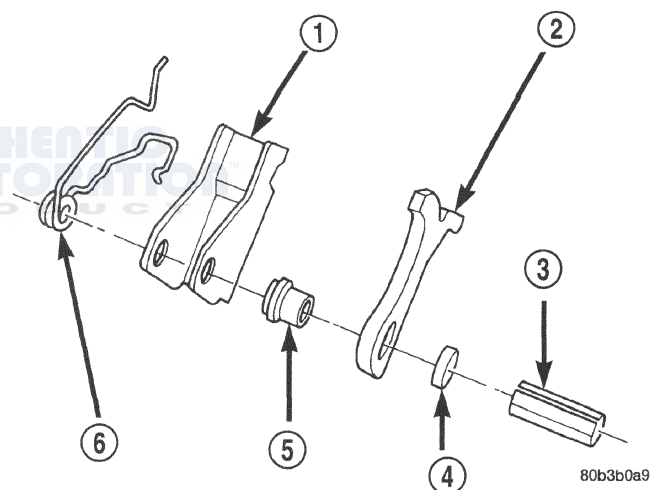
- 1 - LOW/REVERSE CLUTCH PISTON RETAINER  
2 - GASKET

**Fig. 295 Install Low/Reverse Clutch Piston**

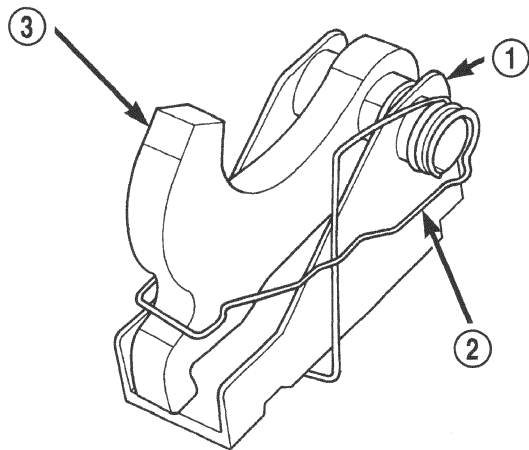
- 1 - LOW/REVERSE CLUTCH PISTON  
2 - LIP SEAL  
3 - LIP SEAL

**Fig. 294 Install Retainer Attaching Screws**

- 1 - LOW/REVERSE CLUTCH PISTON RETAINER  
2 - SCREWDRIVER  
3 - TORX-LOC SCREWS

**Fig. 296 Guide Bracket Disassembled**

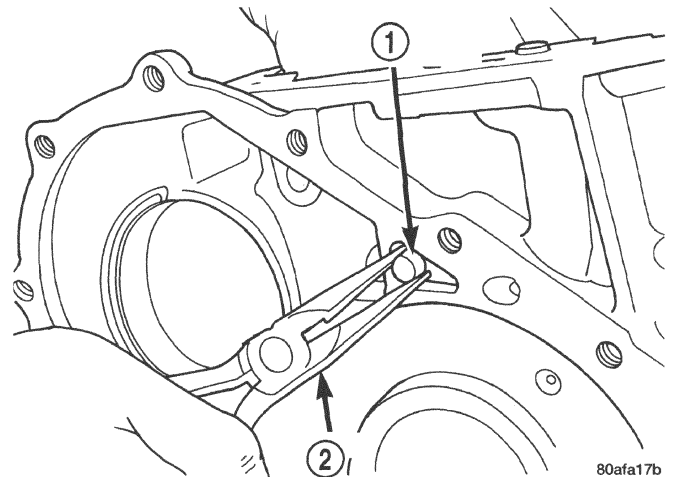
- 1 - GUIDE BRACKET  
2 - PAWL  
3 - SPLIT SLEEVE  
4 - SPACER  
5 - STEPPED SPACER  
6 - ANTIRATCHET SPRING

**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 297 Guide Bracket**

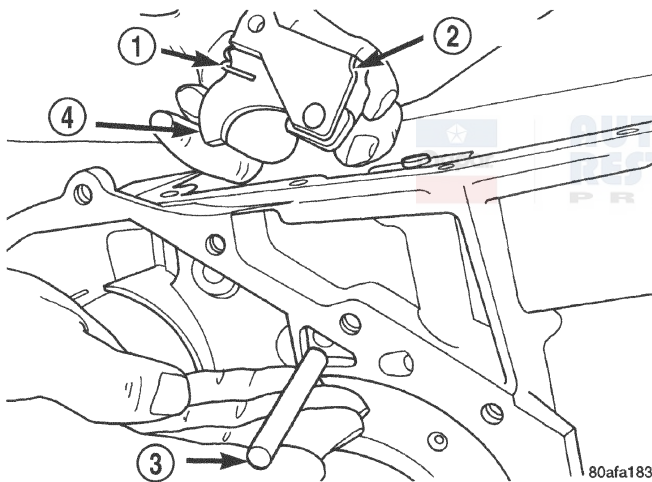
- 1 - GUIDE BRACKET
- 2 - ANTIRATCHET SPRING (MUST BE ASSEMBLED AS SHOWN)
- 3 - PAWL



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**Fig. 299 Install Guide Bracket Pivot Shaft**

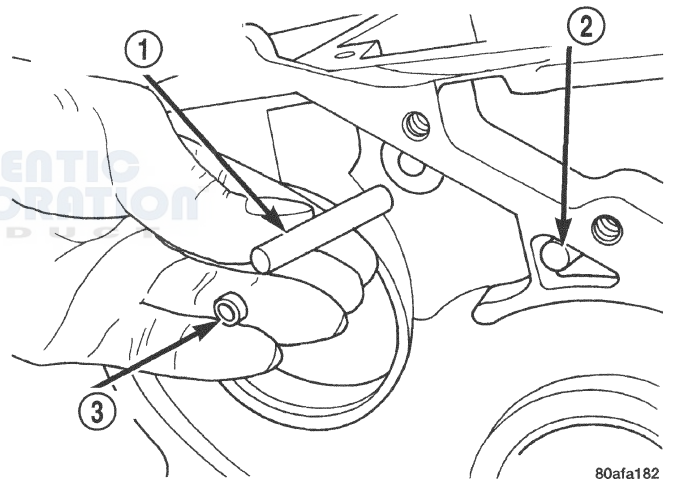
- 1 - GUIDE BRACKET PIVOT SHAFT
- 2 - PLIERS



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**Fig. 298 Pivot Shaft and Guide Bracket**

- 1 - ANTIRACHET SPRING
- 2 - GUIDE BRACKET
- 3 - PIVOT SHAFT
- 4 - PAWL



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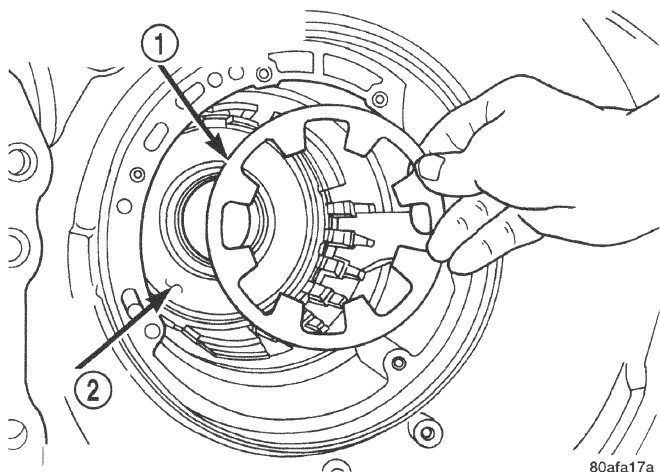
**Fig. 300 Install Anchor Shaft and Plug**

- 1 - GUIDE BRACKET ANCHOR SHAFT
- 2 - PIVOT SHAFT
- 3 - ANCHOR SHAFT PLUG



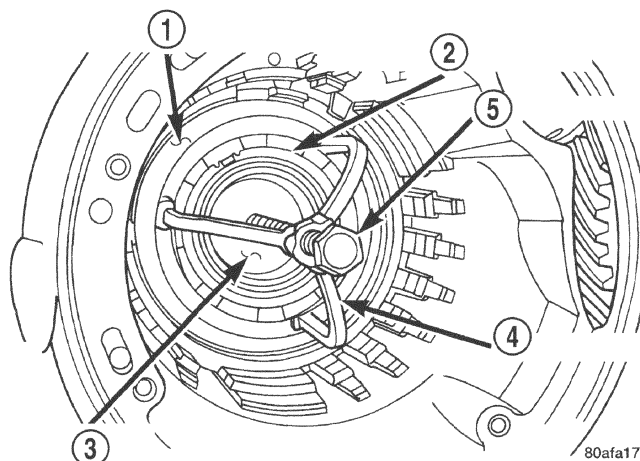
**DISASSEMBLY AND ASSEMBLY (Continued)**

**CAUTION:** When installing, be sure guide bracket and split sleeve touch the rear of the transaxle case.



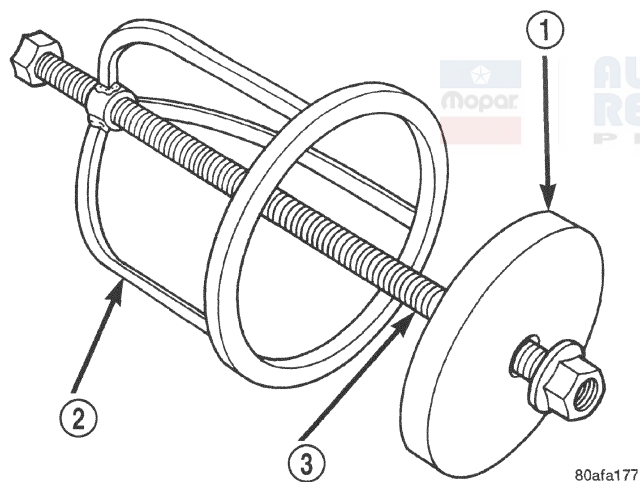
**Fig. 301 Install Low/Reverse Piston Return Spring**

- 1 - LOW/REVERSE PISTON RETURN SPRING
- 2 - PISTON



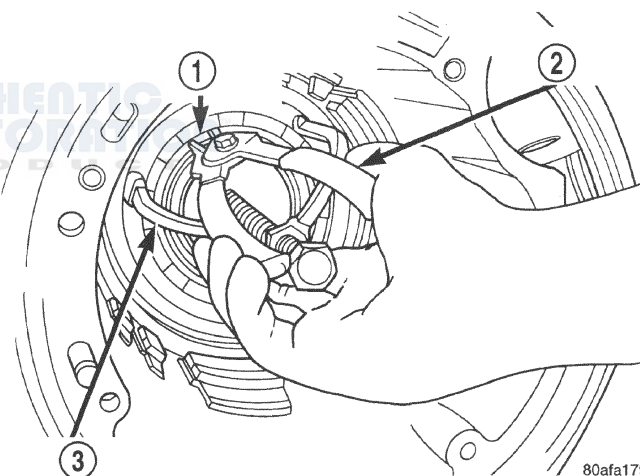
**Fig. 303 Compressor Tool in Use**

- 1 - LOW/REVERSE CLUTCH RETURN SPRING
- 2 - SNAP RING (INSTALL AS SHOWN)
- 3 - TOOL 6057
- 4 - TOOL 5059
- 5 - TOOL 5058-3



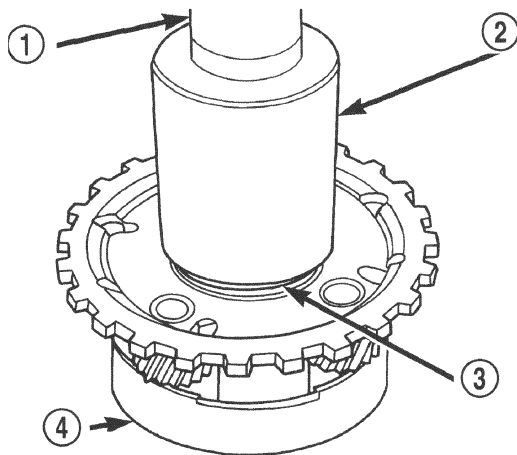
**Fig. 302 Low/Reverse Spring Compressor Tool**

- 1 - TOOL 6057
- 2 - TOOL 5059
- 3 - TOOL 5058-3



**Fig. 304 Install Snap Ring**

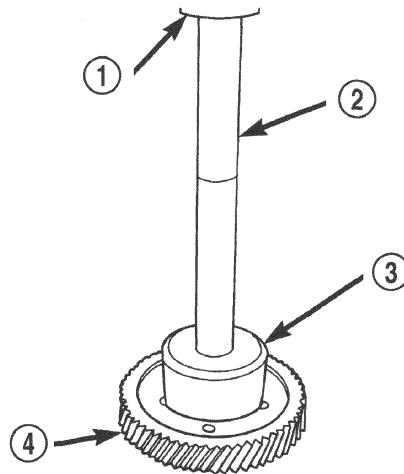
- 1 - SNAP RING OPENING MUST BE BETWEEN SPRING LEVERS (AS SHOWN)
- 2 - SNAP RING PLIERS
- 3 - TOOL 6057

**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 305 Install Rear Carrier Bearing Cone**

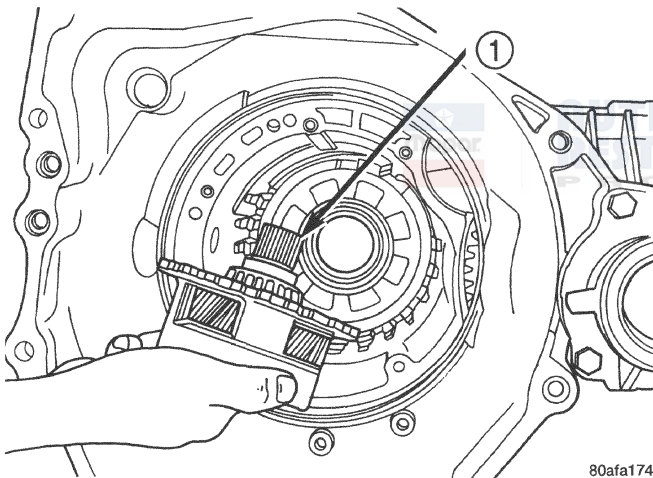
- 1 - ARBOR PRESS RAM
- 2 - TOOL 6053
- 3 - NEW BEARING CONE
- 4 - REAR CARRIER ASSEMBLY



80afa173

**Fig. 307 Install Output Gear Bearing Cone**

- 1 - ARBOR PRESS RAM
- 2 - HANDLE C-4171
- 3 - TOOL 5052
- 4 - OUTPUT GEAR



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**Fig. 306 Install Rear Carrier Assembly**

- 1 - REAR CARRIER ASSEMBLY

**OUTPUT GEAR BEARING ADJUSTMENT**

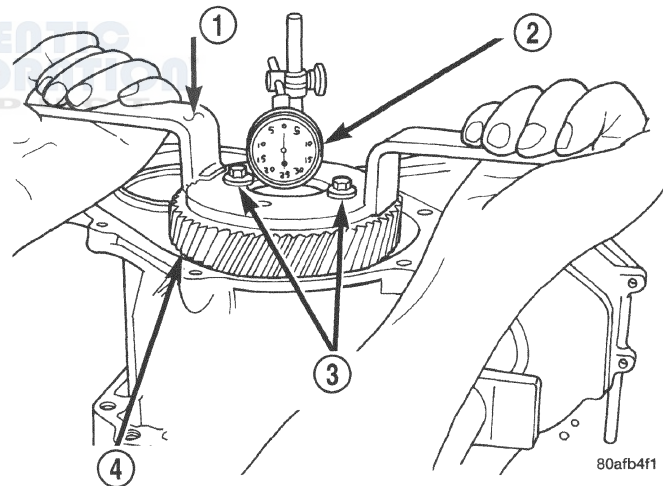
(1) With output gear removed: install a 4.50 mm (0.177 inch) gauging shim on the rear carrier assembly hub, using grease to hold the shim in place.

(2) Using Tool 6259, install output gear and bearing assembly. Torque to 271 N·m (200 ft. lbs.).

To measure bearing end play:

(3) Attach Tool L-4432 to the gear.

(4) Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.



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**Fig. 308 Checking Output Gear Bearings End Play**

- 1 - TOOL L-4432
- 2 - DIAL INDICATOR
- 3 - SPECIAL SCREWS TOOL 6260
- 4 - OUTPUT GEAR

(5) Using a dial indicator, mounted to the transaxle case, measure output gear end play (Fig. 308).

(6) Refer to the output gear bearing shim chart for the required shim to obtain proper bearing setting.

**DISASSEMBLY AND ASSEMBLY (Continued)****OUTPUT GEAR BEARING SHIM CHART**

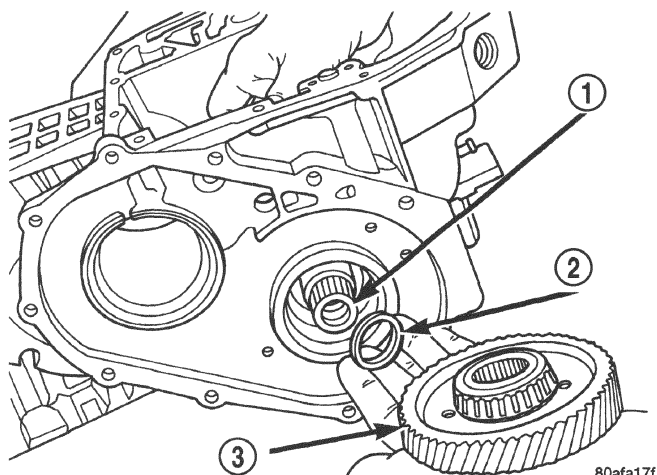
End Play	Shim Needed	Part Number	End Play	Shim Needed	Part Number
0.05mm (0.002 in.)	4.42mm (0.174 in.)	4412830AB	0.53mm (0.021 in.)	3.94mm (0.155 in.)	4412818AB
0.08mm (0.003 in.)	4.38mm (0.172 in.)	4412829AB	0.56mm (0.022 in.)	3.90mm (0.154 in.)	4412817AB
0.10mm (0.004 in.)	4.38mm (0.172 in.)	4412829AB	0.58mm (0.023 in.)	3.90mm (0.154 in.)	4412817AB
0.13mm (0.005 in.)	4.34mm (0.171 in.)	4412828AB	0.61mm (0.024 in.)	3.86mm (0.152 in.)	4412816AB
0.15mm (0.006 in.)	4.30mm (0.169 in.)	4412827AB	0.64mm (0.025 in.)	3.82mm (0.150 in.)	4412815AB
0.18mm (0.007 in.)	4.30mm (0.169 in.)	4412827AB	0.66mm (0.026 in.)	3.82mm (0.150 in.)	4412815AB
0.20mm (0.008 in.)	4.26mm (0.168 in.)	4412826AB	0.69mm (0.027 in.)	3.78mm (0.149 in.)	4412814AB
0.23mm (0.009 in.)	4.22mm (0.166 in.)	4412825AB	0.71mm (0.028 in.)	3.74mm (0.147 in.)	4412813AB
0.25mm (0.010 in.)	4.22mm (0.166 in.)	4412825AB	0.74mm (0.029 in.)	3.74mm (0.147 in.)	4412813AB
0.28mm (0.011 in.)	4.18mm (0.165 in.)	4412824AB	0.76mm (0.030 in.)	3.70mm (0.146 in.)	4412812AB
0.30mm (0.012 in.)	4.14mm (0.163 in.)	4412823AB	0.79mm (0.031 in.)	3.66mm (0.144 in.)	4412811AB
0.33mm (0.013 in.)	4.14mm (0.163 in.)	4412823AB	0.81mm (0.032 in.)	3.66mm (0.144 in.)	4412811AB
0.36mm (0.014 in.)	4.10mm (0.161 in.)	4412822AB	0.84mm (0.033 in.)	3.62mm (0.143 in.)	4412810AB
0.38mm (0.015 in.)	4.10mm (0.161 in.)	4412822AB	0.86mm (0.034 in.)	3.62mm (0.143 in.)	4412810AB
0.41mm (0.016 in.)	4.06mm (0.160 in.)	4412821AB	0.89mm (0.035 in.)	3.58mm (0.141 in.)	4412809AB
0.43mm (0.017 in.)	4.02mm (0.158 in.)	4412820AB	0.91mm (0.036 in.)	3.54mm (0.139 in.)	4412808AB
0.46mm (0.018 in.)	4.02mm (0.158 in.)	4412820AB	0.94mm (0.037 in.)	3.54mm (0.139 in.)	4412808AB
0.48mm (0.019 in.)	3.98mm (0.157 in.)	4412819AB	0.97mm (0.038 in.)	3.50mm (0.138 in.)	4412807AB
0.51mm (0.020 in.)	3.94mm (0.155 in.)	4412818AB			

(7) Use Tool 6259 to remove the retaining bolt and washer. To remove the output gear, use Tool L-4407A.

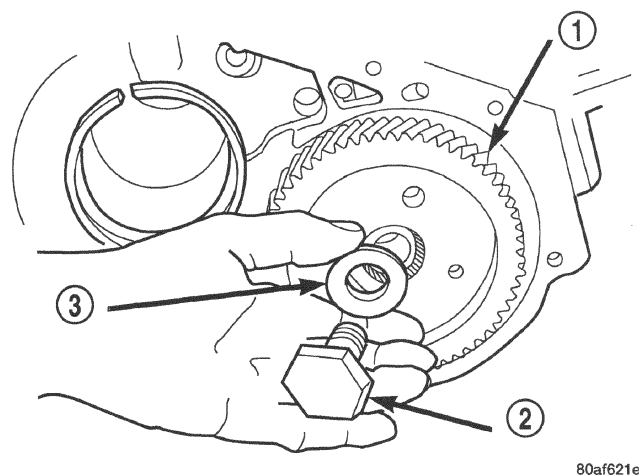
(8) Remove the gauging shim and install the proper shim (Fig. 309). Use grease to hold the shim in place. Install the output gear and bearing assembly (Fig. 310).



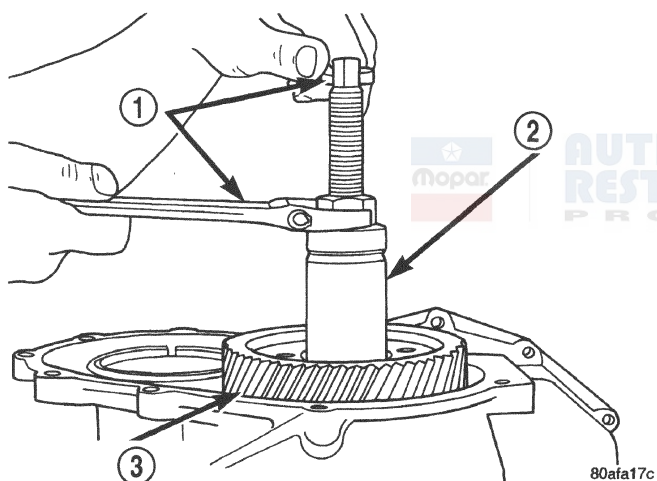
## DISASSEMBLY AND ASSEMBLY (Continued)

**Fig. 309 Output Gear and (Select) Shim**

- 1 - REAR CARRIER ASSEMBLY
- 2 - SHIM (SELECT)
- 3 - OUTPUT GEAR

**Fig. 311 Install Output Gear Bolt and Washer**

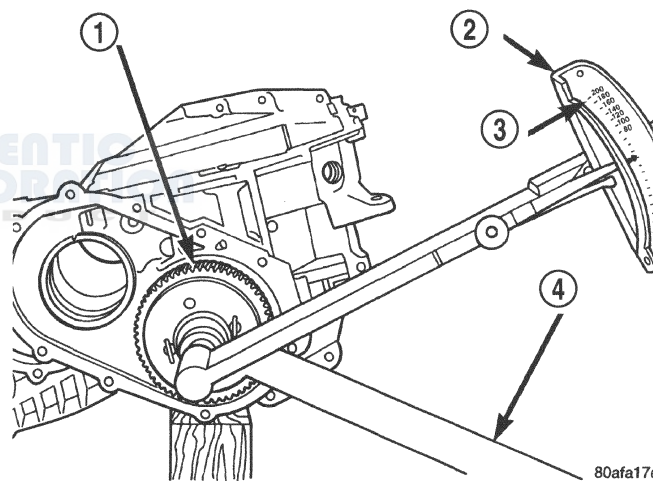
- 1 - OUTPUT GEAR
- 2 - BOLT
- 3 - CONED LOCK WASHER

**Fig. 310 Install Output Gear**

- 1 - WRENCHES
- 2 - TOOL 6261 WITH STUD
- 3 - OUTPUT GEAR

**CAUTION:** Always use new retaining bolt, old retaining bolt may not be reused.

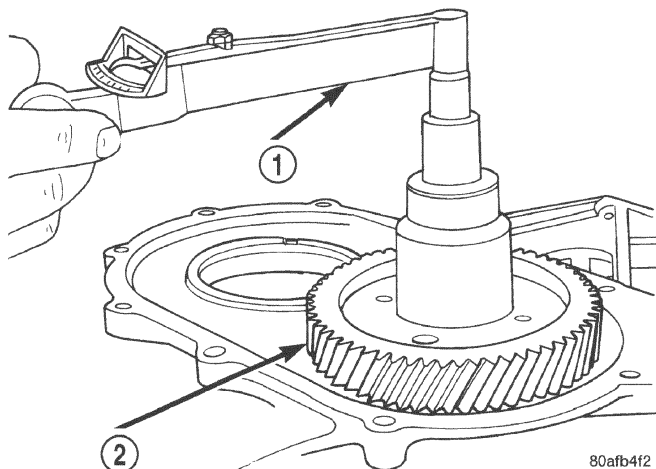
(9) Install the new retaining bolt and washer (Fig. 311). Tighten to 271 N·m (200 ft. lbs.) (Fig. 312).

**Fig. 312 Tighten Output Gear to 271 N•m (200 ft. lbs.)**

- 1 - OUTPUT GEAR
- 2 - TORQUE WRENCH
- 3 - 200 FT. LBS.
- 4 - TOOL 6259

(10) Using an inch-pound torque wrench, check the turning torque (Fig. 313). The torque should be between 3 and 8 inch-pounds.



**DISASSEMBLY AND ASSEMBLY (Continued)**

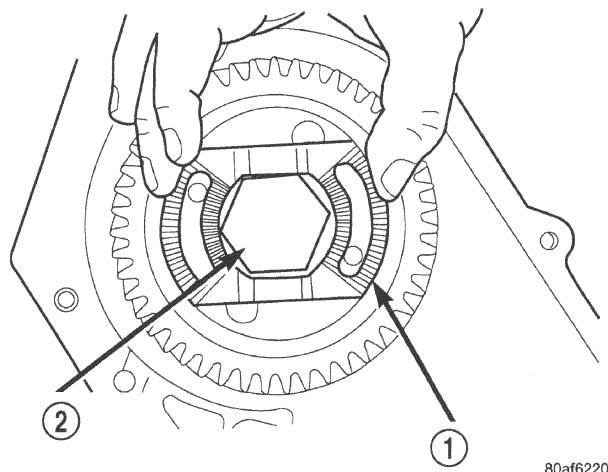
**Fig. 313 Check Output Gear Bearings Turning Torque**

- 1 - INCH-POUND TORQUE WRENCH  
2 - OUTPUT GEAR

If the turning torque is too high, install a 0.04 mm (0.0016 inch) thicker shim. If the turning torque is too low, install a 0.04 mm (0.0016 inch) thinner shim. Repeat until the proper turning torque is 3 to 8 inch pounds.

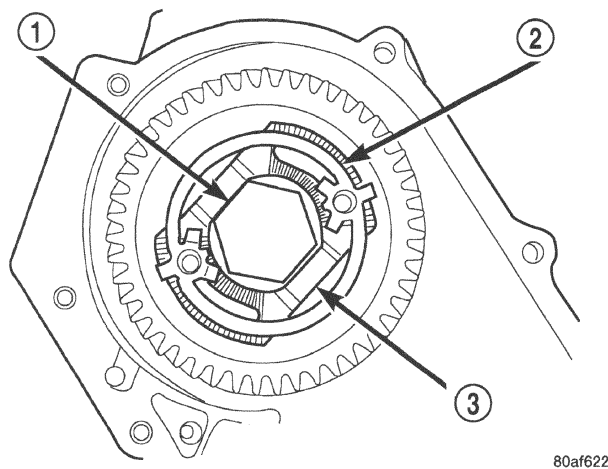
**NOTE:** Install output gear stirrup and strap bolts.

All transaxles utilize a stirrup and retaining strap that is attached to the output gear. The stirrup prevents the output gear retaining bolt from turning and backing out of the rear carrier. The strap is used to hold the stirrup to the output gear and prevent the stirrup retaining bolts from backing out.



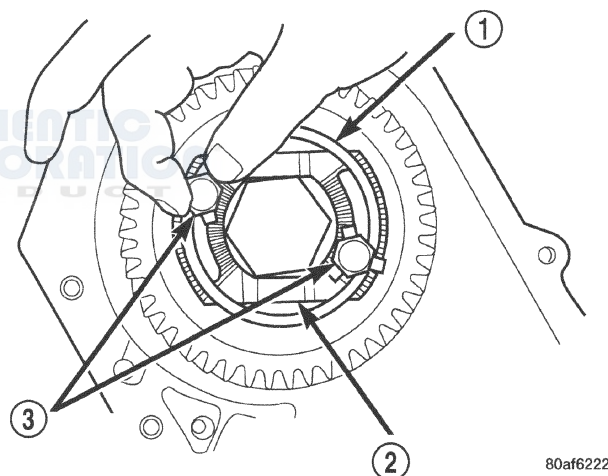
**Fig. 314 Output Gear Retaining Bolt Stirrup (Serration Side Out)**

- 1 - STIRRUP  
2 - OUTPUT GEAR RETAINING BOLT



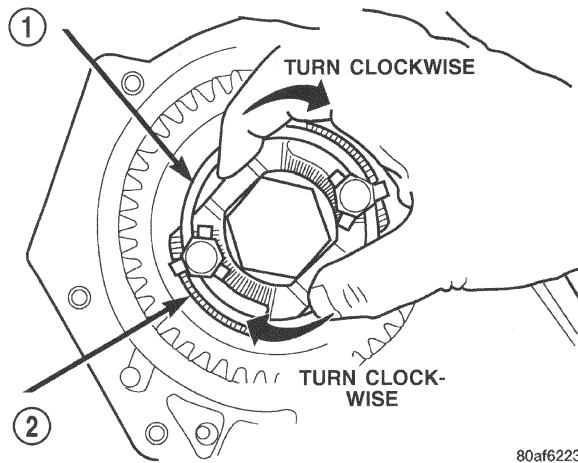
**Fig. 315 Stirrup Strap (Align Strap Holes With Tapped Gear Holes)**

- 1 - OUTPUT GEARBOLT  
2 - RETAINING STRAP  
3 - STIRRUP



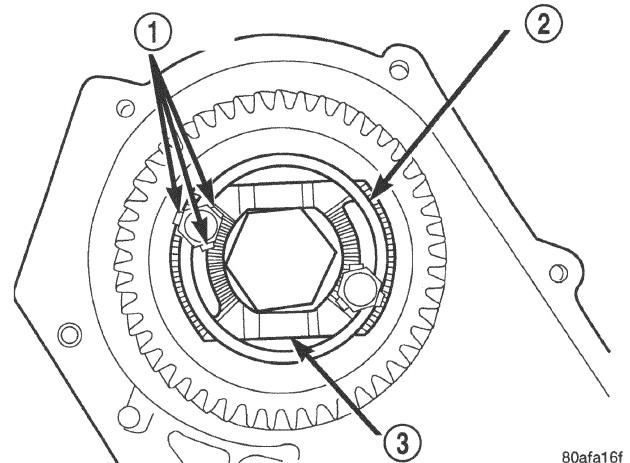
**Fig. 316 Install Strap Bolts**

- 1 - RETAINING STRAP  
2 - STIRRUP  
3 - RETAINING STRAP BOLTS

**DISASSEMBLY AND ASSEMBLY (Continued)**

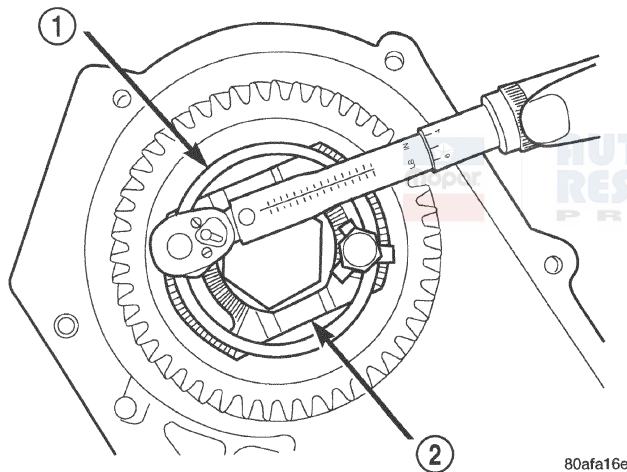
**Fig. 317 Turn Stirrup Clockwise Against Flats Of Output Gear Retaining Bolt**

- 1 - RETAINING STRAP  
2 - STIRRUP



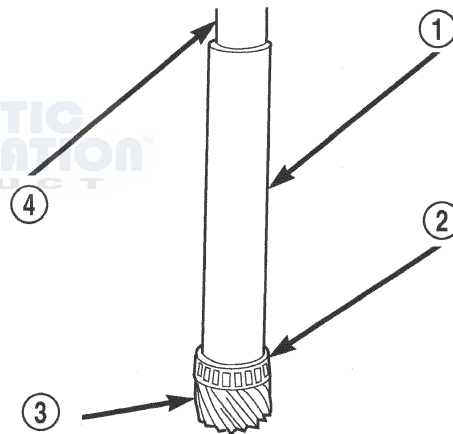
**Fig. 319 Bend Tabs On Strap Up Against Flats Of Bolts**

- 1 - RETAINING STRAP TABS  
2 - RETAINING STRAP  
3 - STIRRUP



**Fig. 318 Tighten Stirrup Strap Bolts To 23 N·m (200 in.) lbs.)**

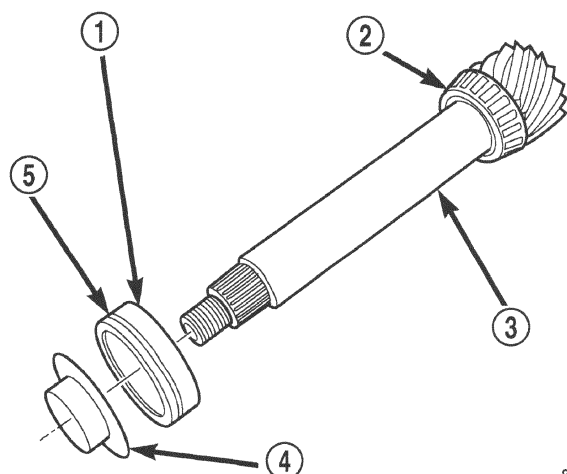
- 1 - RETAINING STRAP  
2 - STIRRUP



**Fig. 320 Install Transfer Shaft Bearing Cone**

- 1 - TOOL 6052  
2 - NEW BEARING CONE  
3 - TRANSFER SHAFT  
4 - ARBOR PRESS RAM

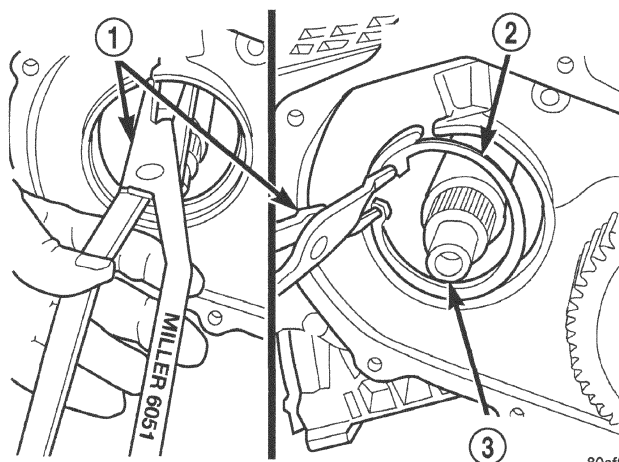
**NOTE:** Screw Tool 5049-A onto transfer shaft. Install transfer shaft.

**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 321 Install Bearing Cup To Shaft**

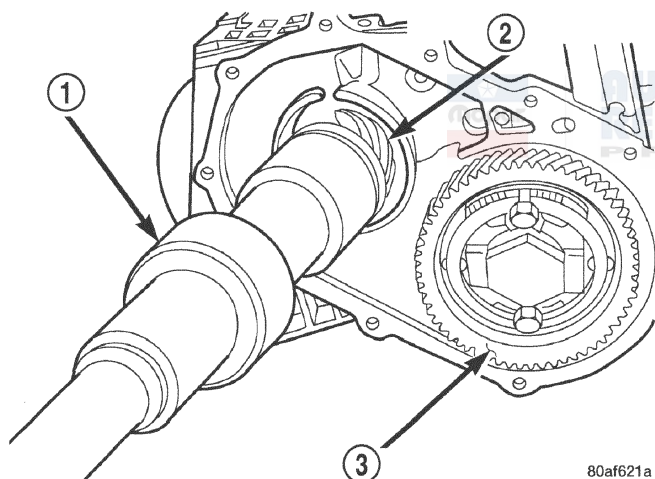
- 1 - BEARING CUP
- 2 - BEARING CONE
- 3 - TRANSFER SHAFT
- 4 - OIL BAFFLE
- 5 - O-RING



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**Fig. 323 Install Transfer Shaft Bearing Snap Ring**

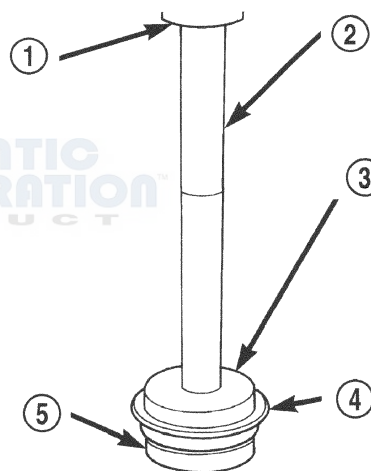
- 1 - SNAP RING PLIERS TOOL 6051
- 2 - TRANSFER SHAFT BEARING SNAP RING
- 3 - TRANSFER SHAFT



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**Fig. 322 Install Transfer Shaft**

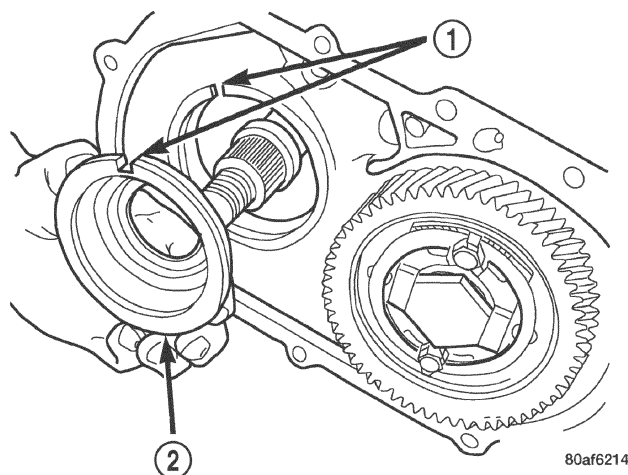
- 1 - SPECIAL TOOL 5049-A
- 2 - TRANSFER SHAFT
- 3 - OUTPUT GEAR



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**Fig. 324 Install Transfer Shaft Bearing Cup Into Retainer**

- 1 - ARBOR PRESS RAM
- 2 - HANDLE C-4171
- 3 - TOOL 6061
- 4 - TRANSFER SHAFT BEARING CUP RETAINER
- 5 - USE REMOVED BEARING CUP TO SUPPORT RETAINER

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 325 Install Bearing Cup Retainer**

- 1 - ALIGN INDEXING TAB TO SLOT  
2 - BEARING CUP RETAINER

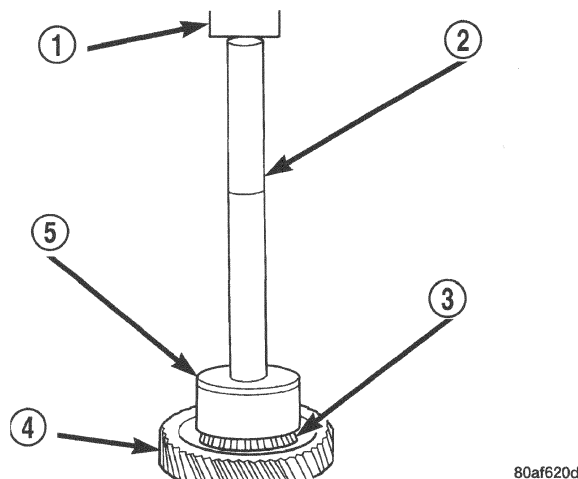
**TRANSFER SHAFT BEARING**

(1) Install a 4.66 mm (0.184 inch) gauging shim on the transfer shaft.

(2) Install transfer shaft gear and bearing assembly and torque the nut to 271 N·m (200 ft. lbs.).

To measure bearing end play:

- Attach Tool L-4432 to the transfer gear.

**Fig. 326 Install Transfer Gear Bearing Cone**

- 1 - ARBOR PRESS RAM  
2 - HANDLE C-4171  
3 - NEW BEARING CONE  
4 - TRANSFER SHAFT GEAR  
5 - TOOL 5052

- Mount a steel ball with grease into the end of the transfer shaft.
- Push and pull the gear while rotating back and forth to insure seating of the bearing rollers.
- Using a dial indicator, measure transfer shaft end play.

**TRANSFER SHAFT BEARING SHIM CHART**

End Play	Shim Needed	Part Number	End Play	Shim Needed	Part Number
0.05mm (0.002 in.)	4.66mm (0.183 in.)	4505588AB	0.76mm (0.030 in.)	3.94mm (0.155 in.)	4412818AB
0.08mm (0.003 in.)	4.62mm (0.182 in.)	4412835AB	0.79mm (0.031 in.)	3.90mm (0.154 in.)	4412817AB
0.10mm (0.004 in.)	4.58mm (0.180 in.)	4412834AB	0.81mm (0.032 in.)	3.90mm (0.154 in.)	4412817AB
0.13mm (0.005 in.)	4.58mm (0.180 in.)	4412834AB	0.84mm (0.033 in.)	3.86mm (0.152 in.)	4412816AB
0.15mm (0.006 in.)	4.54mm (0.178 in.)	4412833AB	0.86mm (0.034 in.)	3.82mm (0.150 in.)	4412815AB
0.18mm (0.007 in.)	4.50mm (0.177 in.)	4412832AB	0.89mm (0.035 in.)	3.82mm (0.150 in.)	4412815AB
0.20mm (0.008 in.)	4.50mm (0.177 in.)	4412832AB	0.91mm (0.036 in.)	3.78mm (0.149 in.)	4412814AB
0.23mm (0.009 in.)	4.46mm (0.175 in.)	4412831AB	0.94mm (0.037 in.)	3.74mm (0.147 in.)	4412813AB
0.25mm (0.010 in.)	4.46mm (0.175 in.)	4412831AB	0.97mm (0.038 in.)	3.74mm (0.147 in.)	4412813AB



**DISASSEMBLY AND ASSEMBLY (Continued)**

End Play	Shim Needed	Part Number	End Play	Shim Needed	Part Number
0.28mm (0.011 in.)	4.42mm (0.174 in.)	4412830AB	0.99mm (0.039 in.)	3.70mm (0.146 in.)	4412812AB
0.30mm (0.012 in.)	4.38mm (0.172 in.)	4412829AB	1.02mm (0.040 in.)	3.66mm (0.144 in.)	4412811AB
0.33mm (0.013 in.)	4.38mm (0.172 in.)	4412829AB	1.04mm (0.041 in.)	3.66mm (0.144 in.)	4412811AB
0.36mm (0.014 in.)	4.34mm (0.171 in.)	4412828AB	1.07mm (0.042 in.)	3.62mm (0.143 in.)	4412810AB
0.38mm (0.015 in.)	4.30mm (0.169 in.)	4412827AB	1.08mm (0.043 in.)	3.62mm (0.143 in.)	4412810AB
0.41mm (0.016 in.)	4.30mm (0.169 in.)	4412827AB	1.12mm (0.044 in.)	3.58mm (0.141 in.)	4412809AB
0.43mm (0.017 in.)	4.26mm (0.168 in.)	4412826AB	1.14mm (0.045 in.)	3.54mm (0.139 in.)	4412808AB
0.46mm (0.018 in.)	4.22mm (0.166 in.)	4412825AB	1.17mm (0.046 in.)	3.54mm (0.139 in.)	4412808AB
0.48mm (0.019 in.)	4.22mm (0.166 in.)	4412825AB	1.19mm (0.047 in.)	3.50mm (0.138 in.)	4412807AB
0.50mm (0.020 in.)	4.18mm (0.165 in.)	4412824AB	1.22mm (0.048 in.)	3.46mm (0.136 in.)	4412806AB
0.53mm (0.021 in.)	4.18mm (0.165 in.)	4412824AB	1.24mm (0.049 in.)	3.46mm (0.136 in.)	4412806AB
0.56mm (0.022 in.)	4.14mm (0.163 in.)	4412823AB	1.27mm (0.050 in.)	3.42mm (0.135 in.)	4412805AB
0.58mm (0.023 in.)	4.10mm (0.161 in.)	4412822AB	1.30mm (0.051 in.)	3.38mm (0.133 in.)	4412804AB
0.61mm (0.024 in.)	4.10mm (0.161 in.)	4412822AB	1.32mm (0.052 in.)	3.38mm (0.133 in.)	4412804AB
0.64mm (0.025 in.)	4.06mm (0.160 in.)	4412821AB	1.35mm (0.053 in.)	3.34mm (0.132 in.)	4412803AB
0.66mm (0.026 in.)	4.02mm (0.158 in.)	4412820AB	1.37mm (0.054 in.)	3.34mm (0.132 in.)	4412803AB
0.69mm (0.027 in.)	4.02mm (0.158 in.)	4412820AB	1.40mm (0.055 in.)	3.30mm (0.130 in.)	4412802AB
0.71mm (0.028 in.)	3.98mm (0.157 in.)	4412819AB	1.45mm (0.057 in.)	3.26mm (0.128 in.)	4412801AB
0.74mm (0.029 in.)	3.94mm (0.155 in.)	4412818AB	1.47mm (0.058 in.)	2.22mm (0.127 in.)	4505570AB

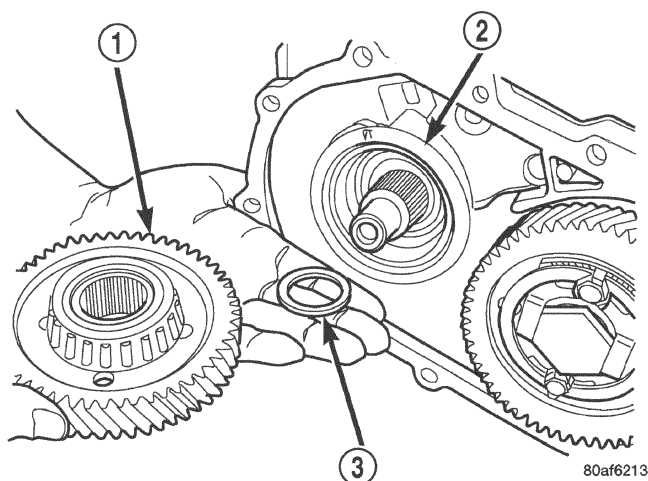
(4) Refer to the Transfer Bearing Shim Chart for the required shim combination to obtain the proper bearing setting.

(5) Use Tool 6259 to remove the retaining nut and washer. Remove the transfer shaft gear using Tool L-4407A.

(6) Remove the gauging shim and install the correct shim (Fig. 327). Install the transfer gear and bearing assembly (Fig. 328).

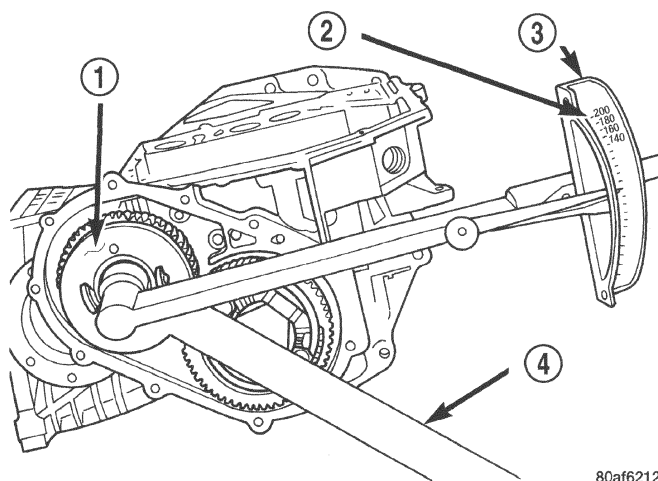
**CAUTION:** Original retaining nut may not be reused. Always use a new retaining nut when reassembling.

## DISASSEMBLY AND ASSEMBLY (Continued)



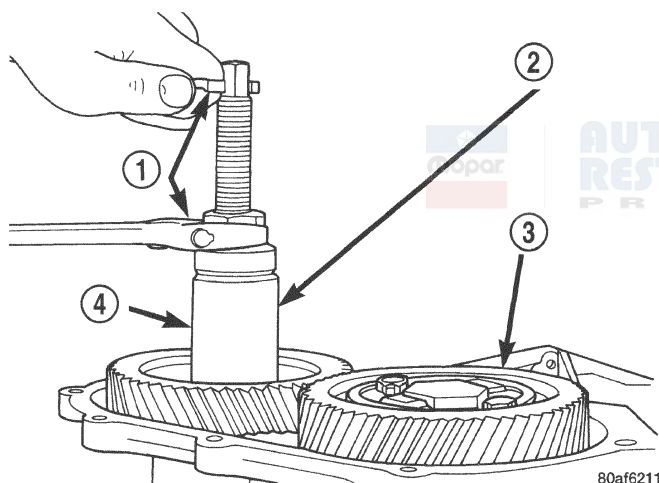
**Fig. 327 Transfer Shaft Gear and (Select) Shim**

- 1 - TRANSFER SHAFT GEAR
- 2 - BEARING CUP RETAINER
- 3 - SHIM (SELECT)



**Fig. 329 Tighten Nut to 271 N•m (200 ft. lbs.)**

- 1 - TRANSFER SHAFT GEAR
- 2 - 200 FT. LBS.
- 3 - TORQUE WRENCH
- 4 - SPECIAL TOOL 6259



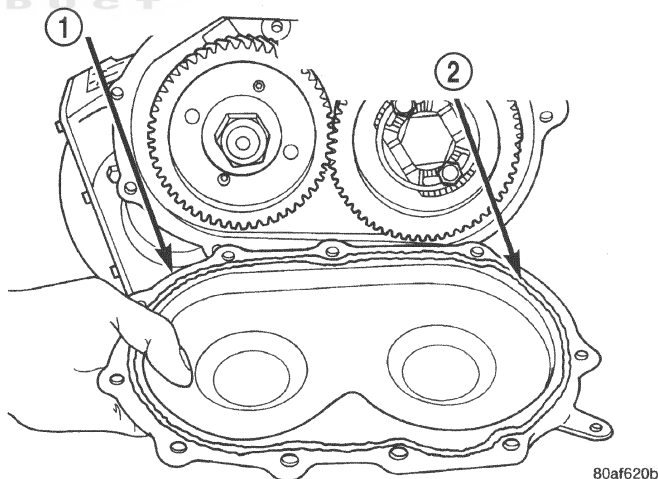
**Fig. 328 Install Transfer Shaft Gear**

- 1 - WRENCHES
- 2 - SPECIAL TOOL 6261
- 3 - OUTPUT GEAR
- 4 - TRANSFER SHAFT GEAR

(7) Install the new retaining nut and washer and torque to 271 N•m (200 ft. lbs.) (Fig. 329). **Measure transfer shaft end play, end play should be 0.05 to 0.10 mm (0.002 to 0.004 inch).**

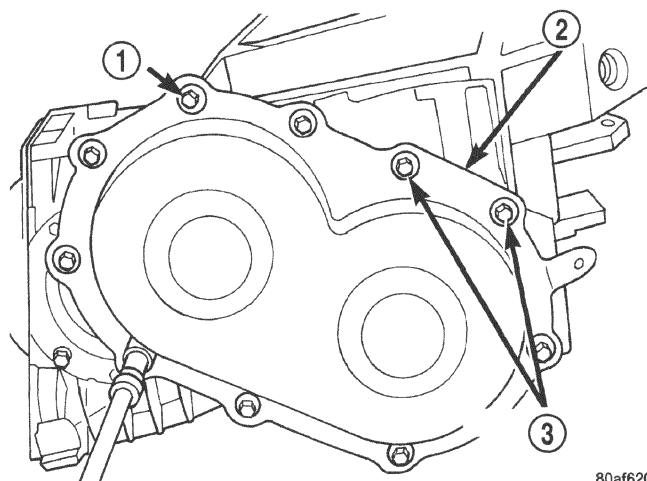
(8) Measure bearing end play as outlined in Step 3. End play should be between 0.05 mm and 0.10 mm (0.002 to 0.004 inch).

**NOTE:** If end play is too high, install a 0.04 mm (0.0016 inch) thinner shim. If end play is too low, install a 0.04 mm (0.0016 inch) thicker shim combination. Repeat until 0.05 to 0.10 mm (0.002 to 0.004 inch) end play is obtained.



**Fig. 330 Install Rear Cover and Torque to 20 N•m (125 in. lbs.)**

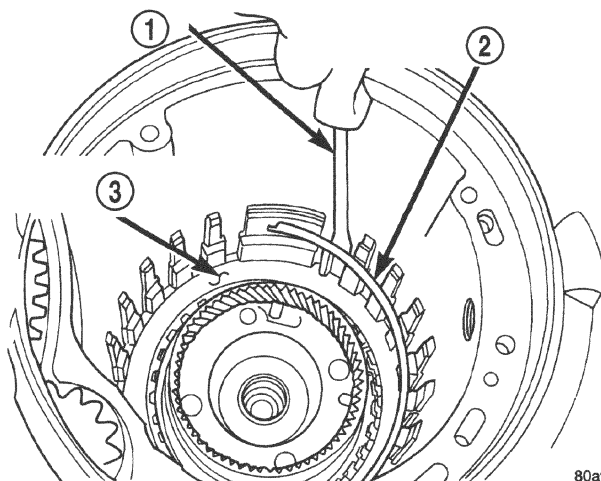
- 1 - REAR COVER
- 2 - 1/8 INCH BEAD OF MOPAR SILICONE RUBBER ADHESIVE SEALANT AS SHOWN

**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 331 Install Rear Cover Bolts**

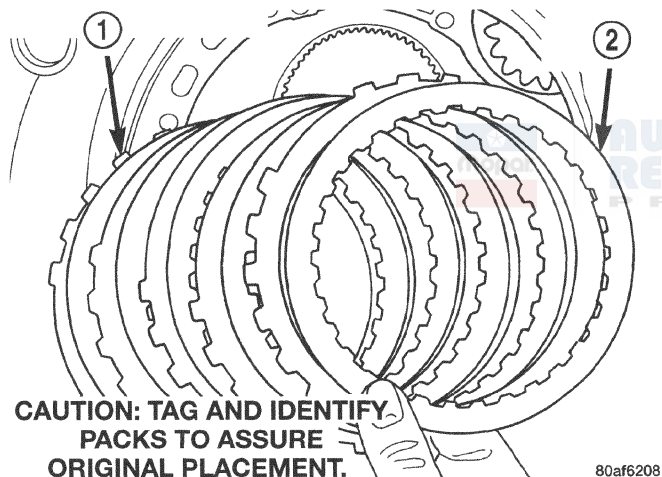
- 1 - REAR COVER BOLTS
- 2 - REAR COVER
- 3 - USE SEALANT ON BOLTS



80af6207

**Fig. 333 Install Low/Reverse Reaction Plate Snap Ring**

- 1 - SCREWDRIVER
- 2 - LOW/REVERSE REACTION PLATE FLAT SNAP RING
- 3 - DO NOT SCRATCH CLUTCH PLATE

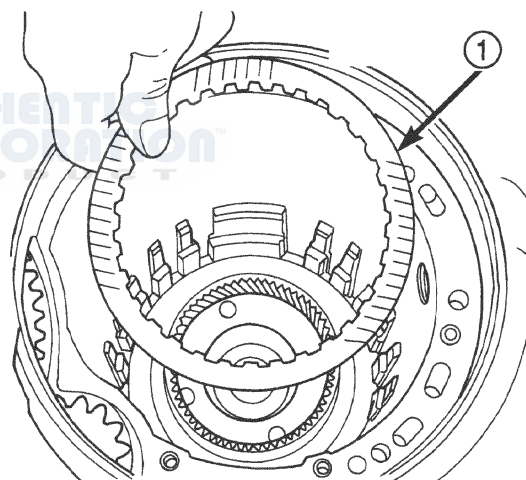


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**CAUTION: TAG AND IDENTIFY  
PACKS TO ASSURE  
ORIGINAL PLACEMENT.**

**Fig. 332 Install Low/Reverse Clutch Pack**

- 1 - CLUTCH PLATES (5)
- 2 - CLUTCH DISCS (5)



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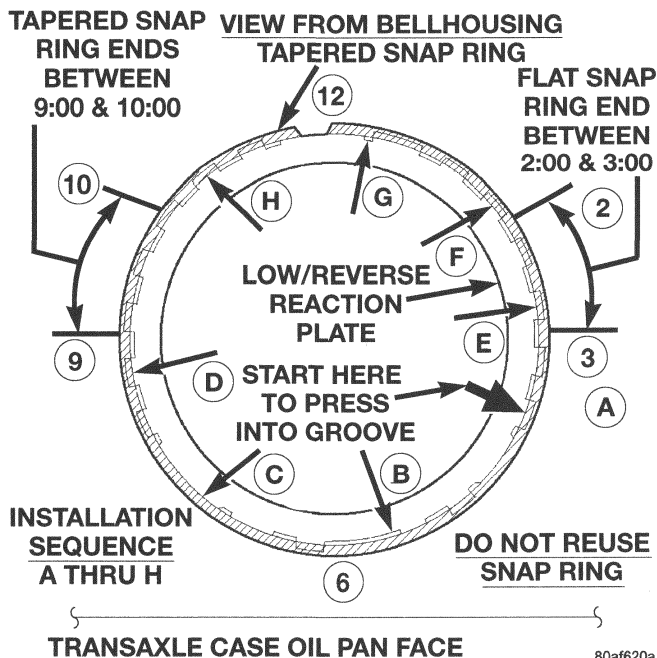
**Fig. 334 Install One Disc**

- 1 - ONE DISC FROM LOW/REVERSE CLUTCH

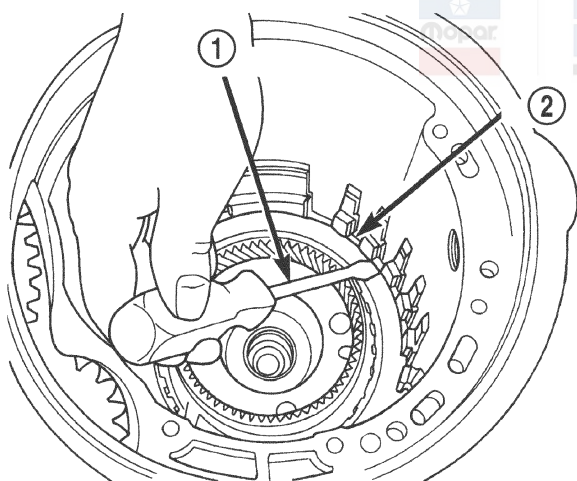


**DISASSEMBLY AND ASSEMBLY (Continued)**

NOTE: Install the low/reverse reaction plate stepped side up.



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**Fig. 335 Tapered Snap Ring Instructions**

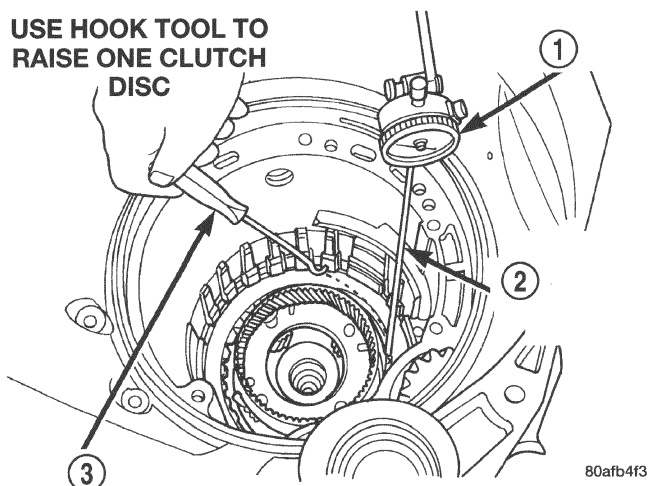
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**Fig. 336 Snap Ring Installed**

- 1 - SCREWDRIVER  
2 - TAPERED SNAP RING (INSTALL AS SHOWN)

Press down clutch pack with finger and zero dial indicator. **Low/Reverse clutch pack clearance is 0.86 to 1.52 (0.034 to 0.060 inch).**

USE HOOK TOOL TO RAISE ONE CLUTCH DISC



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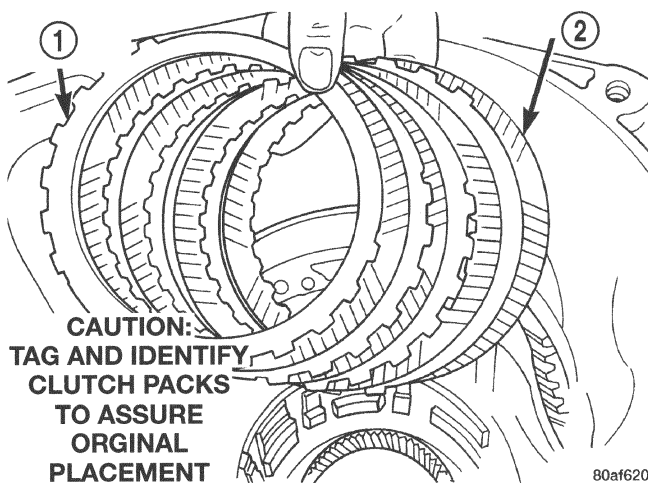
**Fig. 337 Check Low/Reverse Clutch Clearance**

- 1 - DIAL INDICATOR  
2 - DIAL INDICATOR TIP TOOL 6268  
3 - HOOK TOOL

Select the proper low/reverse reaction plate to achieve specifications:

**LOW/REVERSE REACTION PLATE CHART**

PART NUMBER	THICKNESS
4799846AA	5.88 mm (0.232 in.)
4799847AA	6.14 mm (0.242 in.)
4799848AA	6.40 mm (0.252 in.)
4799849AA	6.66 mm (0.262 in.)
4799855AA	6.92 mm (0.273 in.)



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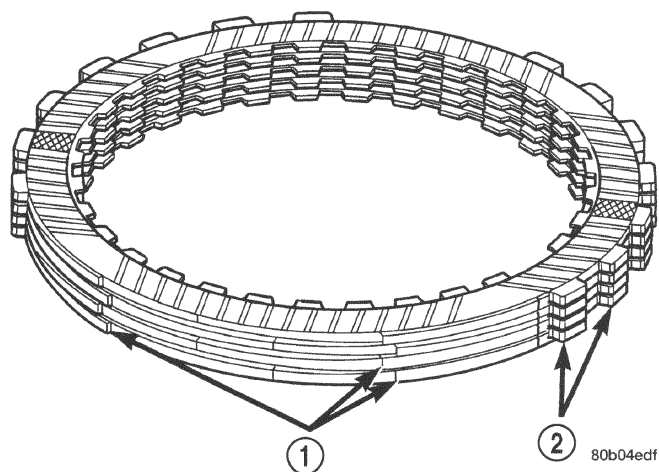
**Fig. 338 Install 2/4 Clutch Pack**

- 1 - CLUTCH PLATE (4)  
2 - CLUTCH DISC (4)



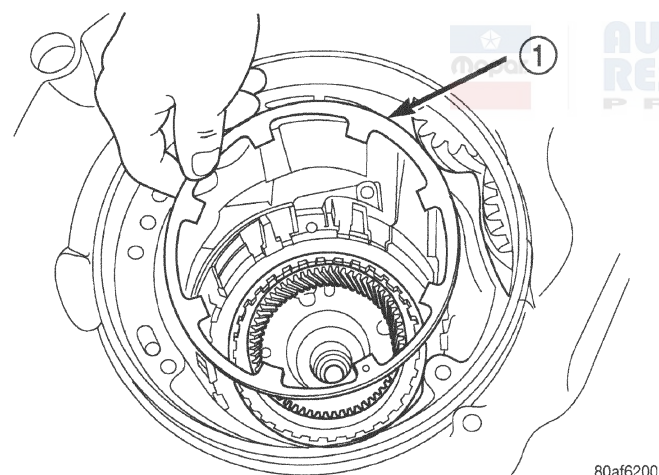
**DISASSEMBLY AND ASSEMBLY (Continued)**

NOTE: When installing the 2-4 clutch plates and discs, the orientation should be alternated so the pilot pads of adjacent plates do not align, refer to (Fig. 339).



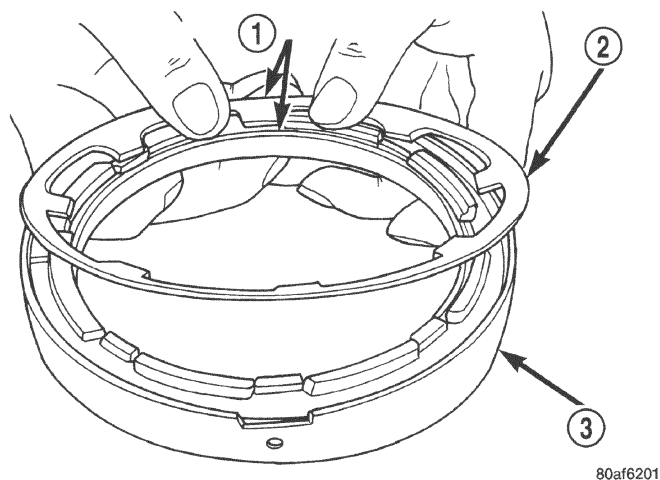
**Fig. 339 Stagger 2/4 Clutch Plate Pads**

- 1 - PILOT PADS
- 2 - LUGS



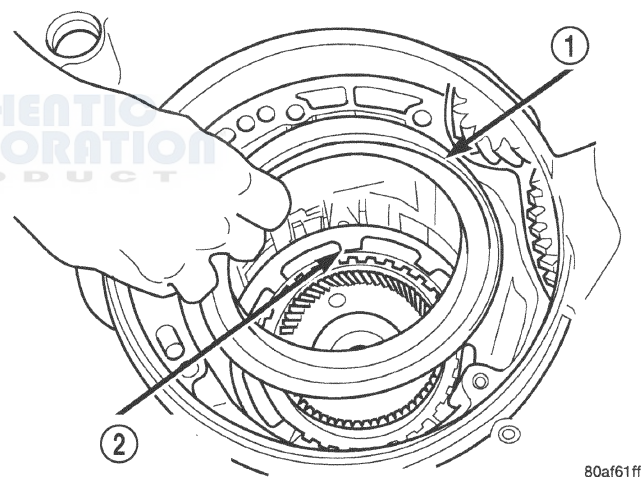
**Fig. 340 Install 2/4 Clutch Return Spring**

- 1 - 2/4 CLUTCH RETURN SPRING



**Fig. 341 Proper Orientation of 2/4 Clutch Retainer and Spring**

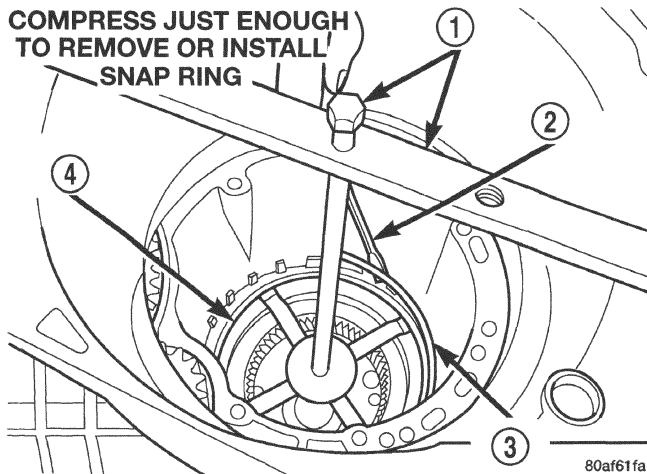
- 1 - NOTE POSITION
- 2 - RETURN SPRING
- 3 - 2/4 CLUTCH RETAINER



**Fig. 342 Install 2/4 Clutch Retainer**

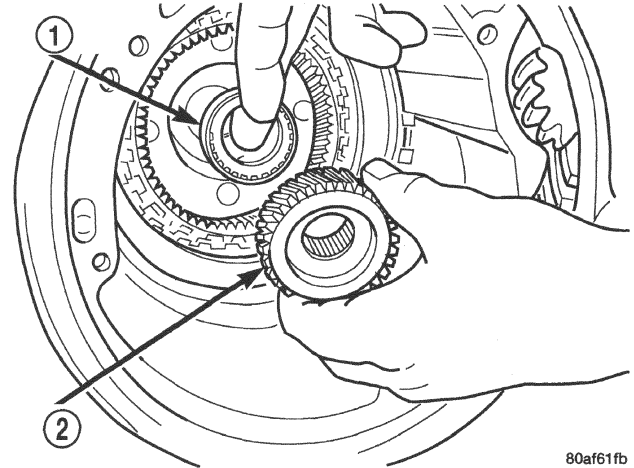
- 1 - 2/4 CLUTCH RETAINER
- 2 - 2/4 CLUTCH RETURN SPRING

NOTE: Verify that Miller Tool 5058 is centered properly to the 2/4 clutch retainer before depressing the tool.

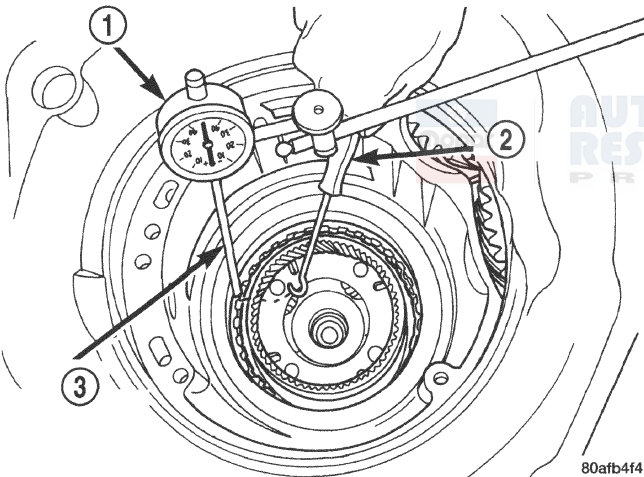
**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 343 Install 2/4 Clutch Retainer Snap Ring**

- 1 - TOOL 5058
- 2 - SCREWDRIVER
- 3 - SNAP RING
- 4 - 2/4 CLUTCH RETAINER

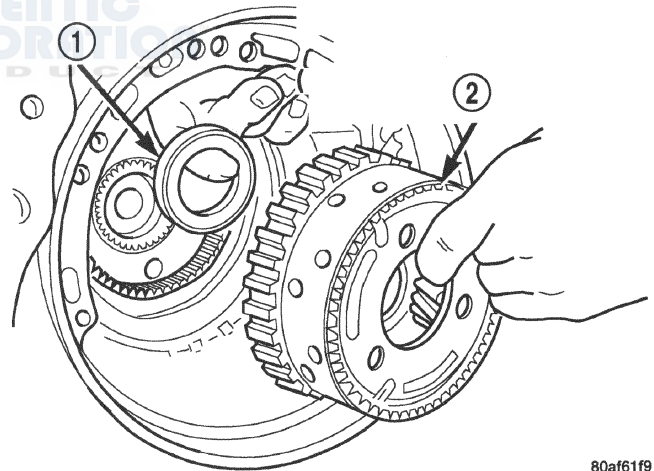
Press down clutch pack with finger and zero dial indicator. **The 2/4 clutch pack clearance is 0.76 to 2.64mm (0.030 to 0.104 inch).** If not within specifications, the clutch is not assembled properly. **There is no adjustment for the 2/4 clutch clearance.**

**Fig. 345 Install Rear Sun Gear**

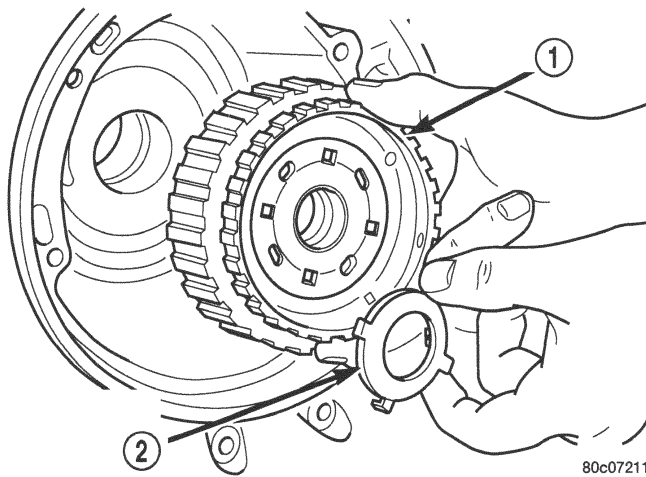
- 1 - #7 NEEDLE BEARING
- 2 - REAR SUN GEAR

**Fig. 344 Check 2/4 Clutch Clearance**

- 1 - DIAL INDICATOR
- 2 - HOOK TOOL
- 3 - DIAL INDICATOR TIP TOOL 6268

**Fig. 346 Install Front Carrier and Rear Annulus Assembly**

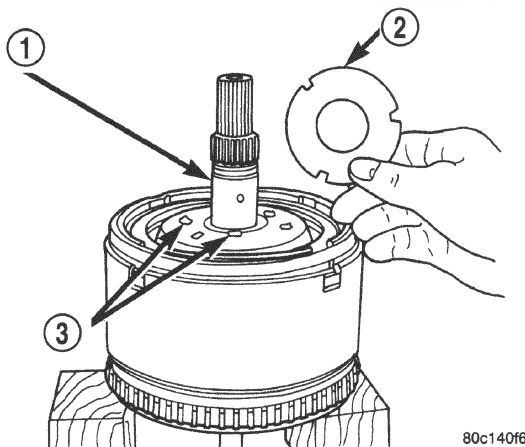
- 1 - #6 NEEDLE BEARING
- 2 - FRONT CARRIER AND REAR ANNULUS ASSEMBLY (TWIST AND PULL OR PUSH TO REMOVE OR INSTALL).

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 347 Install Front Sun Gear Assembly**

- 1 - FRONT SUN GEAR ASSEMBLY
- 2 - #4 THRUST WASHER (FOUR TABS)

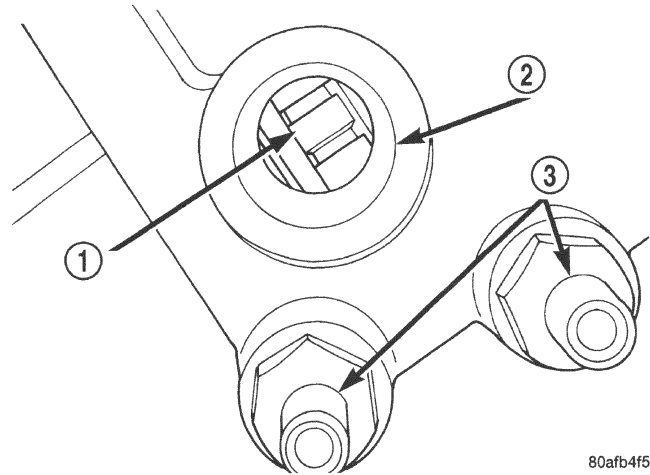
**DETERMINING No. 4 THRUST PLATE THICKNESS—INPUT SHAFT END PLAY**

To determine the proper thickness of the No. 4 thrust plate, select the thinnest No. 4 thrust plate. Using petrolatum (Fig. 348) to hold thrust plate in position, install input clutch assembly. Be sure the input clutch assembly is completely seated (Fig. 349).

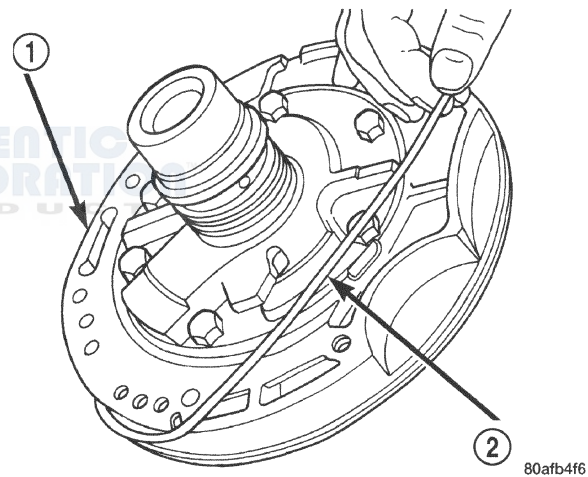
**Fig. 348 Select Thinnest No. 4 Thrust Plate**

- 1 - OVERDRIVE SHAFT ASSEMBLY
- 2 - #4 THRUST PLATE (SELECT)
- 3 - 3 DABS OF PETROLATUM FOR RETENTION

**CAUTION:** If view through input speed sensor hole is not as shown above, the input clutches assembly is not seated properly.

**Fig. 349 View Through Input Speed Sensor Hole**

- 1 - INPUT CLUTCHES RETAINER
- 2 - INPUT (TURBINE) SPEED SENSOR HOLE
- 3 - OIL COOLER NIPPLES

**Fig. 350 Remove Oil Pump O-Ring**

- 1 - OIL PUMP ASSEMBLY
- 2 - O-RING

Remove the oil pump O-ring (Fig. 350). You will be able to install and remove the oil pump and gasket very easily to select the proper No. 4 thrust plate.

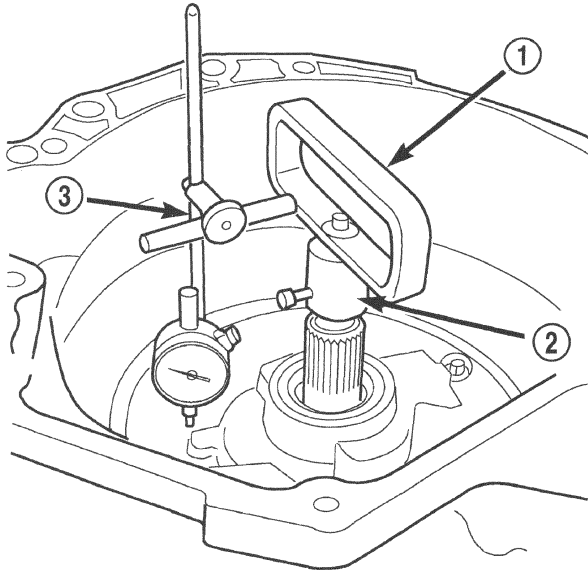
**NOTE:** Use screw-in dowels or phillips-head screwdrivers to align pump to case.

**CAUTION:** Be sure to reinstall O-ring on oil pump after selecting the proper No. 4 thrust plate.



## DISASSEMBLY AND ASSEMBLY (Continued)

Set up input shaft for measurement with Indicator Set C3339 and End Play Set 8266 as shown in (Fig. 351). Measure the input shaft end play with the transaxle in the vertical position. This will ensure that the measurement will be accurate.



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**Fig. 351 Measure Input Shaft End Play Using End Play Set 8266**

- 1 - TOOL 8266-8
- 2 - TOOL 8266-2
- 3 - TOOL C-3339

**NOTE:** Input shaft end play must be 0.005 to 0.025 inch.

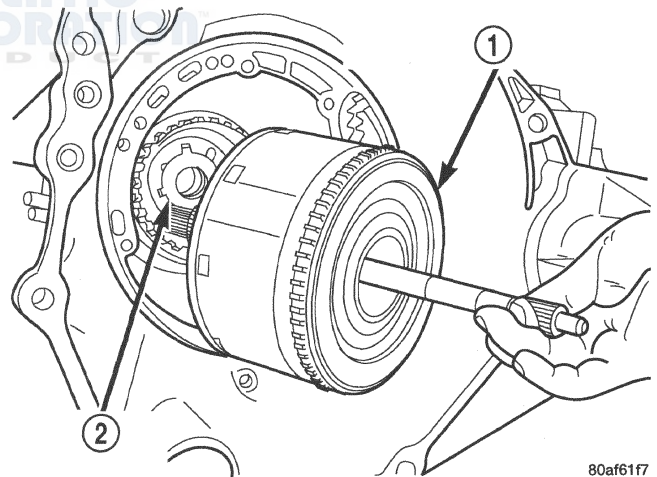
For example, if end play reading is 0.055 inch, select No. 4 Thrust Plate which is 0.071 to 0.074 thick. This should provide an input shaft end play reading of 0.020 inch which is within specifications.

See chart to select the proper No. 4 thrust plate.

Reinstall the input clutch assembly with the selected thrust plate.

### NO. 4 THRUST PLATE CHART

PART NUMBER	THICKNESS
4431662	0.91mm (0.036 in.)
4431663	1.14mm (0.045 in.)
4431664	1.37mm (0.054 in.)
4431665	1.60mm (0.063 in.)
3836237	1.73mm (0.068 in.)
4431666	1.80mm (0.071 in.)
3836238	1.96mm (0.077 in.)
4431667	2.03mm (0.080 in.)
3836239	2.16mm (0.085 in.)
4431668	2.24mm (0.088 in.)
3836240	2.39mm (0.094 in.)
4431669	2.46mm (0.097 in.)
3836241	2.62mm (0.103 in.)
4446670	2.67mm (0.105 in.)
4446671	2.90mm (0.114 in.)
4446672	3.15mm (0.124 in.)
4446601	3.38mm (0.133 in.)

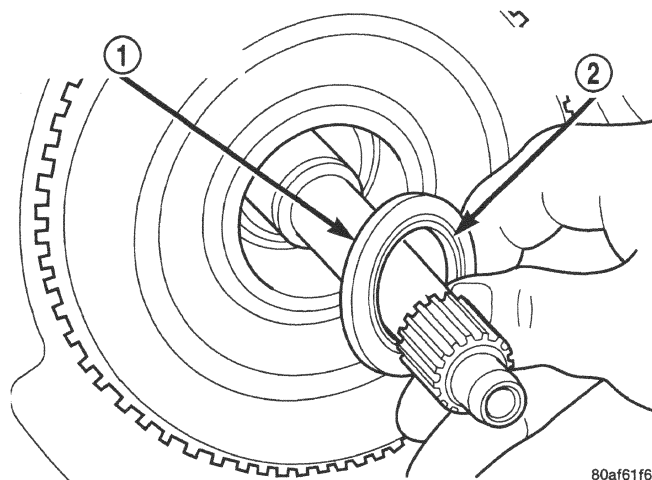


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**Fig. 352 Install Input Clutches Assembly**

- 1 - INPUT CLUTCHES ASSEMBLY
- 2 - #4 THRUST WASHER



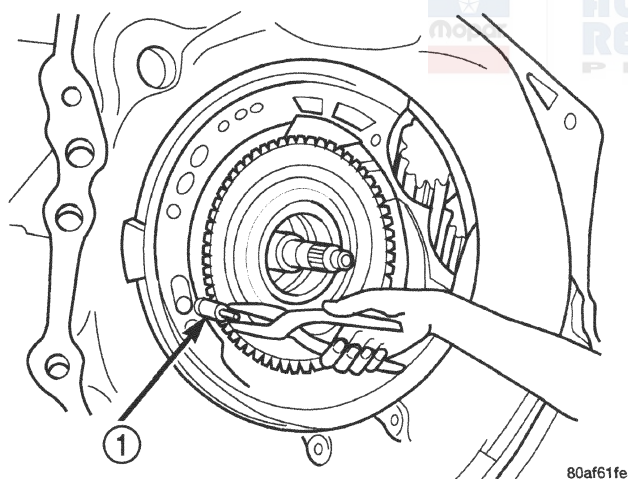
**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 353 Install Caged Needle Bearing**

- 1 - #1 CAGED NEEDLE BEARING  
 2 - NOTE: TANGED SIDE OUT

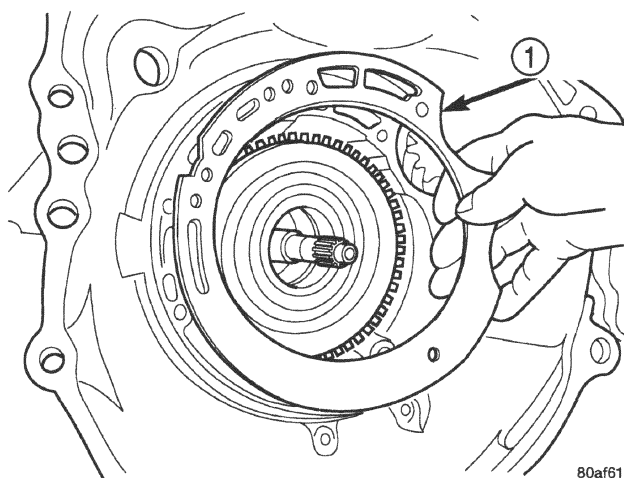
**CAUTION:** The cooler bypass valve must be replaced if a transaxle failure has occurred. Do not reuse old valve or attempt to clean old valve. When installing bypass valve, insert with O-ring end towards rear of case.



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**Fig. 354 Install Bypass Valve**

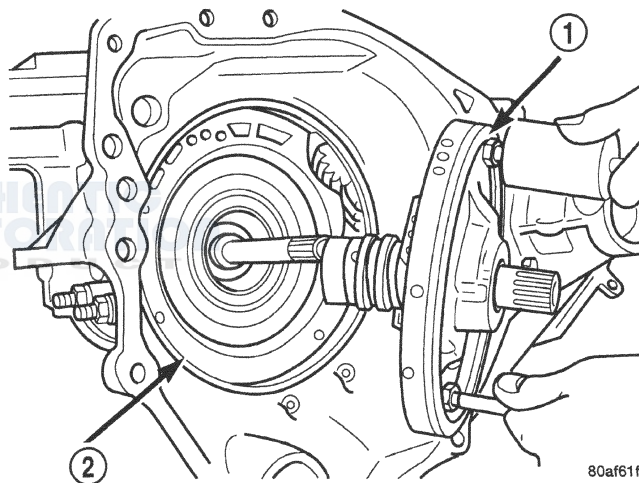
- 1 - COOLER BYPASS VALVE



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**Fig. 355 Install Oil Pump Gasket**

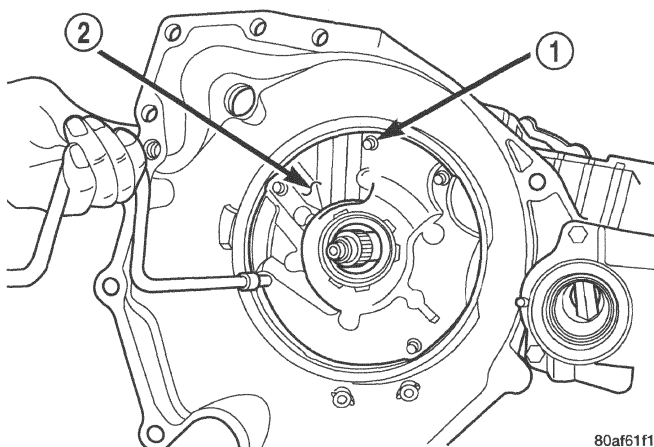
- 1 - PUMP GASKET



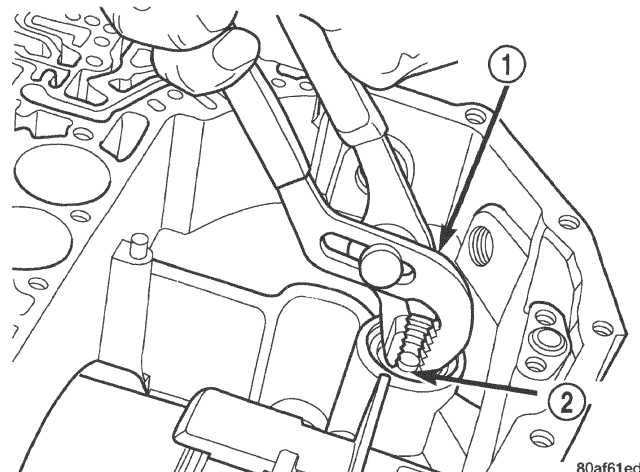
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**Fig. 356 Install Oil Pump**

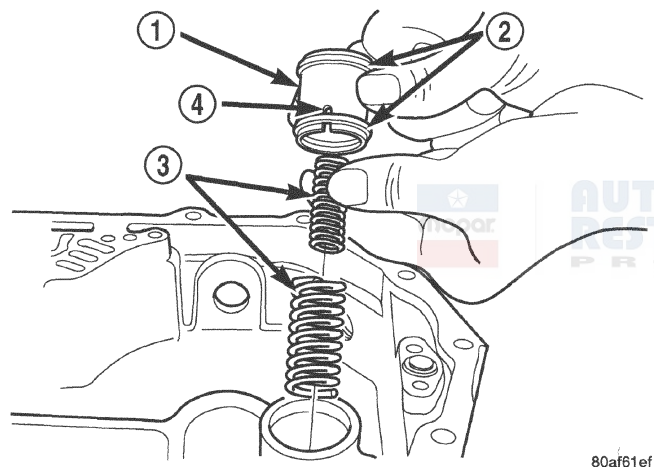
- 1 - OIL PUMP  
 2 - GASKET

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 357 Install Pump Attaching Bolts**

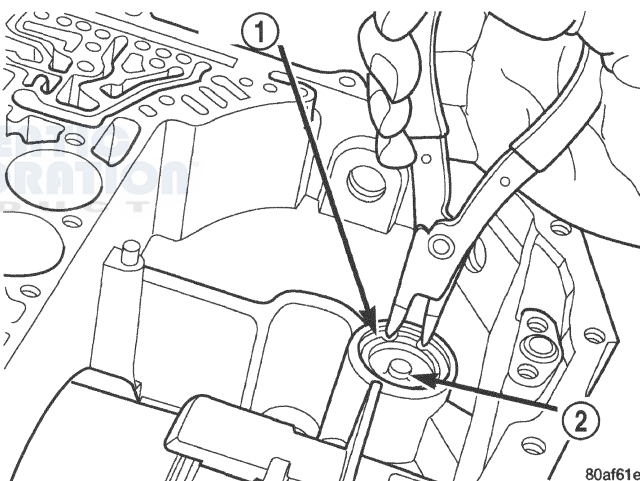
- 1 - PUMP ATTACHING BOLTS
- 2 - PUMP HOUSING

**Fig. 359 Install Low/Reverse Accumulator Plug (Cover)**

- 1 - ADJUSTABLE PLIERS
- 2 - PLUG

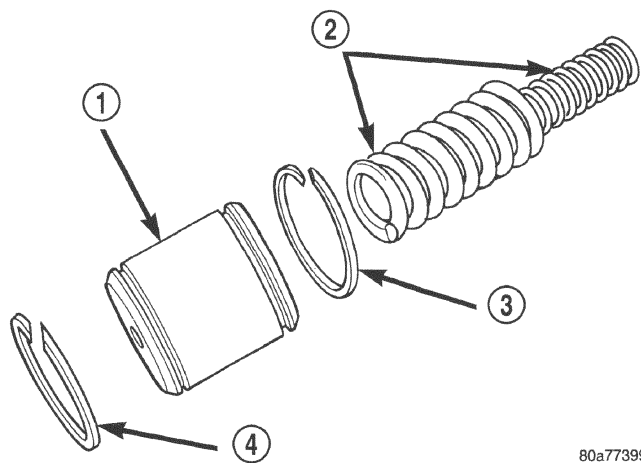
**Fig. 358 Install Low/Reverse Accumulator**

- 1 - ACCUMULATOR PISTON
- 2 - SEAL RINGS
- 3 - RETURN SPRINGS
- 4 - (NOTE NOTCH)

**Fig. 360 Install Low/Reverse Accumulator Snap Ring**

- 1 - SNAP RING
- 2 - PLUG

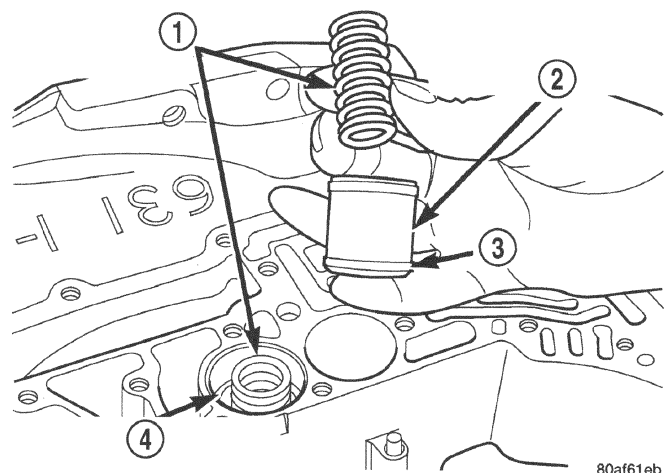
**NOTE:** Dependent on engine application, some accumulators will have two springs and others will have one spring. The springs are color coded for application and year.

**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 361 Accumulator (Underdrive)**

- 1 - ACCUMULATOR PISTON (UNDERDRIVE)
- 2 - RETURN SPRINGS
- 3 - SEAL RING
- 4 - SEAL RING

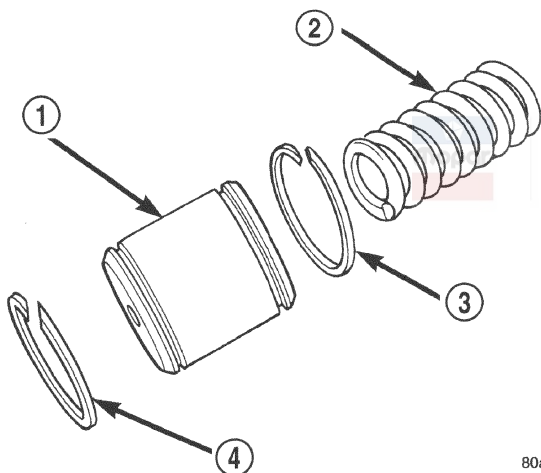


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**Fig. 363 Install Accumulators**

- 1 - RETURN SPRING
- 2 - UNDERDRIVE CLUTCH ACCUMULATOR
- 3 - SEAL RING (2)
- 4 - OVERDRIVE CLUTCH ACCUMULATOR

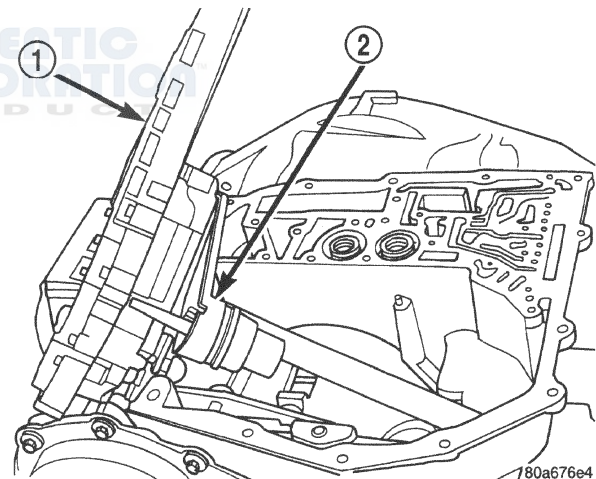
**CAUTION:** Do not handle the valve body from the manual valve. Damage could result.



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**Fig. 362 Accumulator (Overdrive)**

- 1 - ACCUMULATOR PISTON (OVERDRIVE)
- 2 - RETURN SPRING
- 3 - SEAL RING
- 4 - SEAL RING

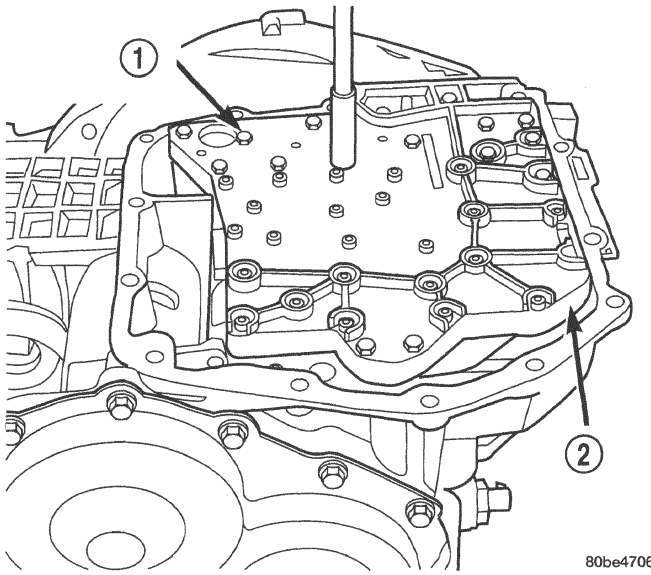


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**Fig. 364 Install Valve Body**

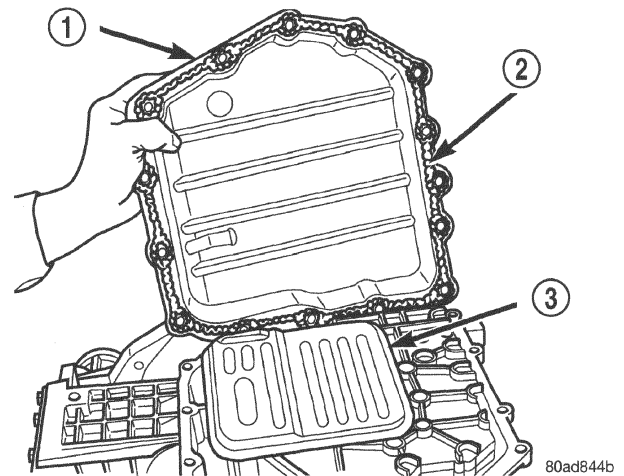
- 1 - VALVE BODY
- 2 - TRANSMISSION RANGE SENSOR

**NOTE:** To ease installation of the valve body, turn the manual valve fully clockwise.

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 365 Install Valve Body Attaching Bolts**

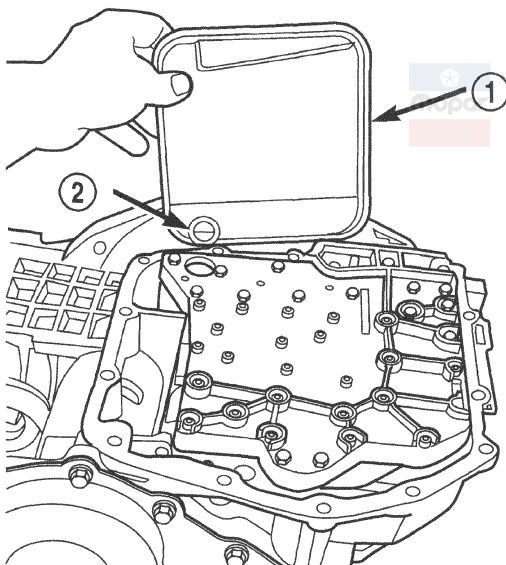
- 1 - VALVE BODY ATTACHING BOLTS (18)  
2 - VALVE BODY

80be4706

**Fig. 367 Install Oil Pan**

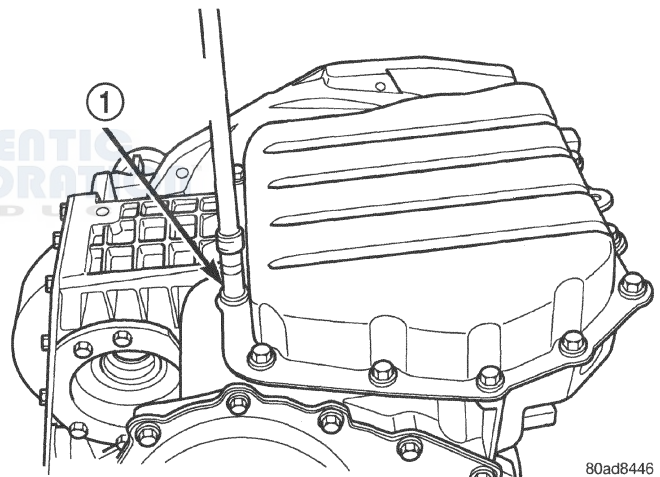
- 1 - OIL PAN  
2 - 1/8 INCH BEAD OF RTV SEALANT  
3 - OIL FILTER

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**Fig. 366 Install Oil Filter and New O-Ring**

- 1 - OIL FILTER  
2 - O-RING

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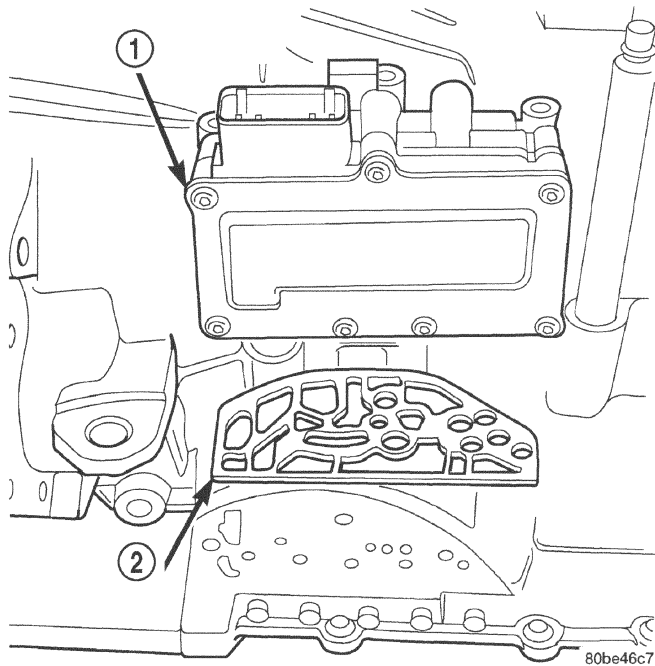
**Fig. 368 Install Pan Bolts**

- 1 - OIL PAN BOLTS (USE RTV UNDER BOLT HEADS)

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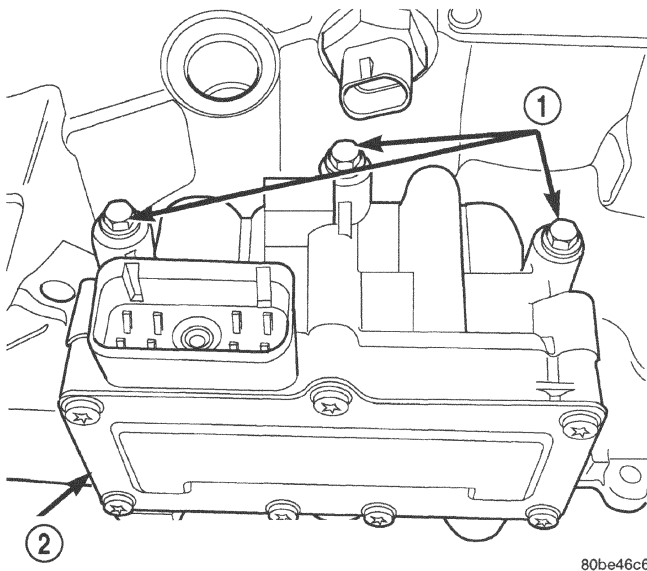
(1) Install transaxle solenoid pack and new gasket (Fig. 369).



**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 369 Install Solenoid Pack**

- 1 - SOLENOID/PRESSURE SWITCH ASSEMBLY  
2 - GASKET

(2) Install and tighten solenoid/pressure switch assembly-to-transaxle case bolts to 12 N·m (110 in.) lbs.) torque (Fig. 370).

**Fig. 370 Solenoid/Pressure Switch Assembly-to-Case Mounting Bolts**

- 1 - BOLTS  
2 - SOLENOID AND PRESSURE SWITCH ASSEMBLY

(3) Install input and output speed sensors.

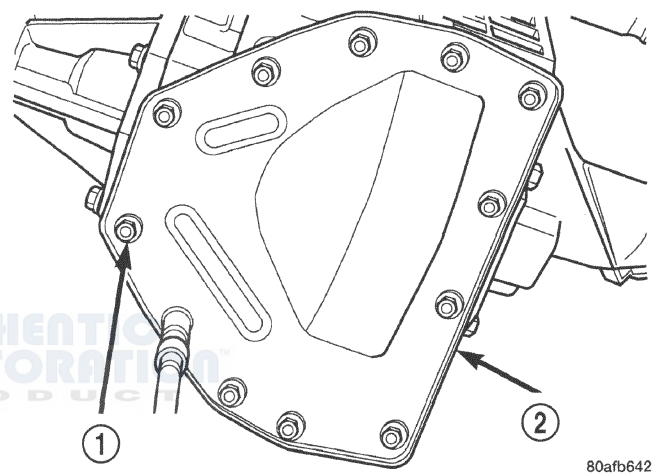
**DIFFERENTIAL REPAIR**

**NOTE:** The differential is serviced as an assembly. The only parts that are serviceable within the differential are the differential bearing cups and cones. If any other part fails within the differential, you must replace the differential assembly along with the transfer shaft.

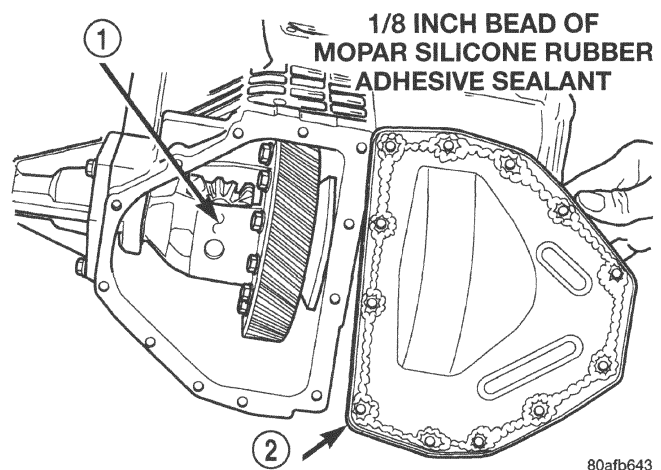
**DISASSEMBLY**

The transfer shaft should be removed for differential repair and bearing turning torque checking.

(1) Remove the differential cover and bolts (Fig. 371) (Fig. 372).

**Fig. 371 Differential Cover Bolts**

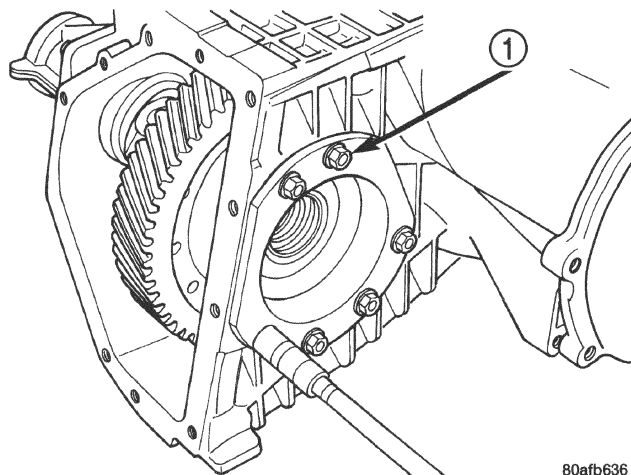
- 1 - DIFFERENTIAL COVER BOLTS  
2 - DIFFERENTIAL COVER

**Fig. 372 Remove Differential Cover**

- 1 - DIFFERENTIAL ASSEMBLY  
2 - DIFFERENTIAL COVER

**DISASSEMBLY AND ASSEMBLY (Continued)**

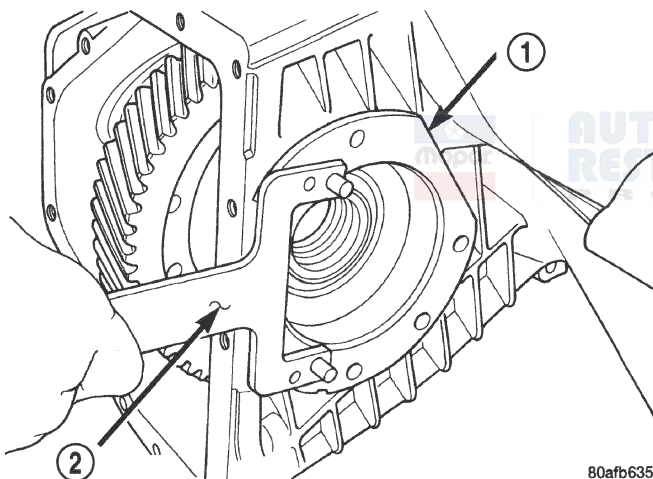
(2) Remove the differential bearing retainer and bolts (Fig. 373) (Fig. 374).



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**Fig. 373 Differential Retainer Bolts**

1 - DIFFERENTIAL RETAINER BOLTS



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**Fig. 374 Remove Bearing Retainer**

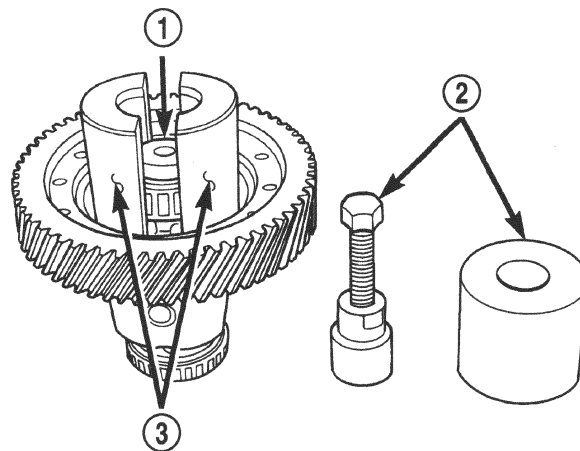
1 - DIFFERENTIAL BEARING RETAINER  
2 - TOOL L-4435

(3) Using a plastic hammer, remove extension housing/adaptor plate on the right side of the transaxle.

**WARNING: HOLD ONTO DIFFERENTIAL ASSEMBLY TO PREVENT IT FROM ROLLING OUT OF HOUSING.**

(4) Use Miller Special Tool 5048, 5048-3 Collets, and L-4539-2 Button to remove the differential bearing cone on the extension housing side.

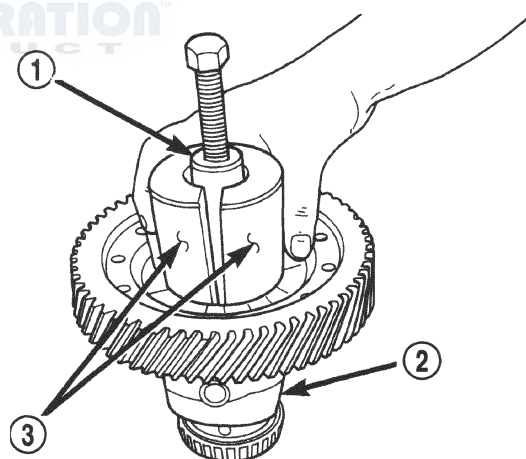
(5) Use Miller Special Tool 5048, 5048-4 Collets, and L-4539-2 Button to remove the differential bearing cone on the bearing retainer side (Fig. 375) (Fig. 376) (Fig. 377).



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**Fig. 375 Position Button and Collets Onto Differential and Bearing (Ring Gear Side)**

1 - SPECIAL TOOL L-4539-2  
2 - SPECIAL TOOL 5048  
3 - SPECIAL TOOL 5048-4



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**Fig. 376 Position Tool 5048 Over Button and Collets at Differential Bearing (Ring Gear Side)**

1 - SPECIAL TOOL 5048  
2 - DIFFERENTIAL  
3 - SPECIAL TOOL 5048-4

DISASSEMBLY AND ASSEMBLY (Continued)

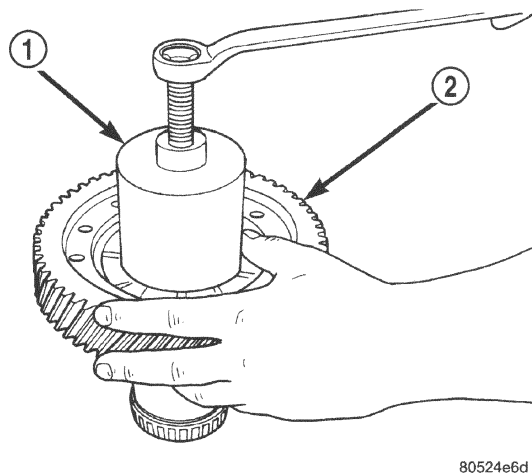


Fig. 377 Remove Differential Bearing Cone (Ring Gear Side)

- 1 - SPECIAL TOOL 5048
- 2 - RING GEAR

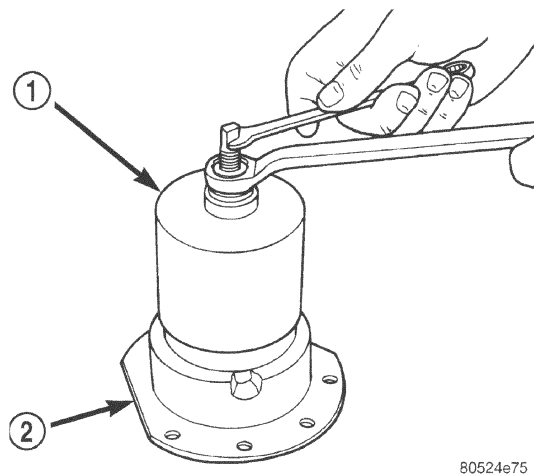


Fig. 379 Remove Bearing Cup

- 1 - SPECIAL TOOL 6062A
- 2 - DIFFERENTIAL BEARING RETAINER

- (6) Using Miller Special Tool L-4518, remove the differential bearing race from the extension housing.
- (7) Using Miller Special Tool 6062A, remove the differential bearing race from the bearing retainer (Fig. 378) (Fig. 379).

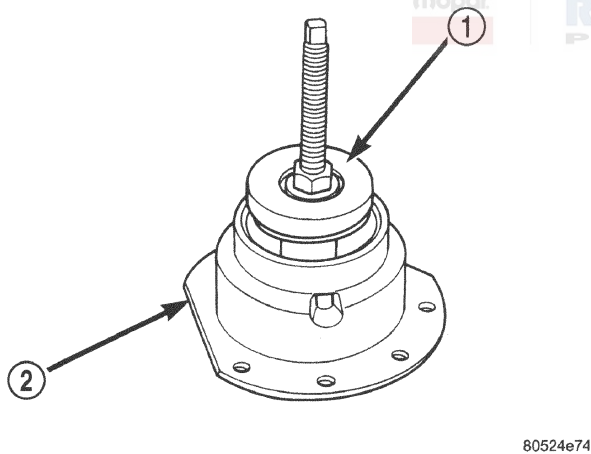


Fig. 378 Position Bearing Cup Remover Tool in Retainer

- 1 - SPECIAL TOOL 6062A
- 2 - DIFFERENTIAL BEARING RETAINER

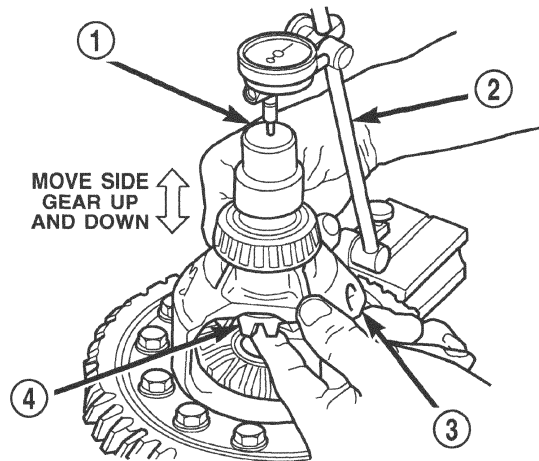
DIFFERENTIAL SERVICE TOOLS

COMPONENT	REMOVER	INSTALLER
Diff. Bear. On Retainer Side	5048, 5048-4 Collets, L-4539-2 Button	5052, C-4171
Diff. Bear. On Ext. Hous. Side	5048, 5048-3 Collets, L-4539-2 Button	L-4410, C-4171
Diff. Race. On Retainer Side	6062-A	6061, C-4171
Diff. Race. On Ext. Hous. Side	L-4518	L-4520, C-4171
Extension Housing Seal	7794-A, C-637 Slide Hammer	L-4520, C-4171
Bearing Retainer Seal	794-A, C-637 Slide Hammer	L-4520, C-4171

CHECKING SIDE GEAR END PLAY

Check side gear end play whenever the differential is removed for service.



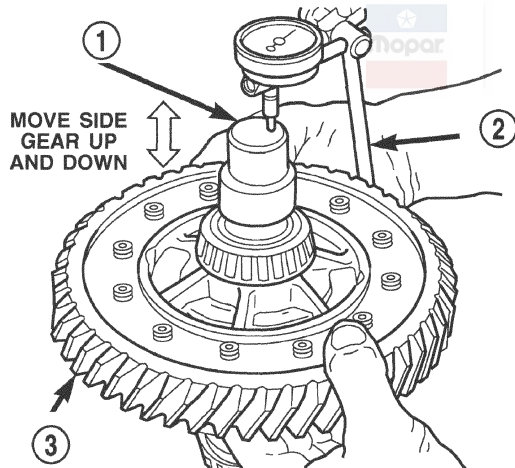
**DISASSEMBLY AND ASSEMBLY (Continued)**

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**Fig. 380 Checking Side Gear End Play (Extension Housing Side)**

- 1 - SPECIAL TOOL C-4996 (NOTE POSITION)
- 2 - DIAL INDICATOR SET
- 3 - DIFFERENTIAL ASSEMBLY
- 4 - SIDE GEAR

**NOTE:** Side gear end play must be **BETWEEN 0.001 to 0.013 inch.**



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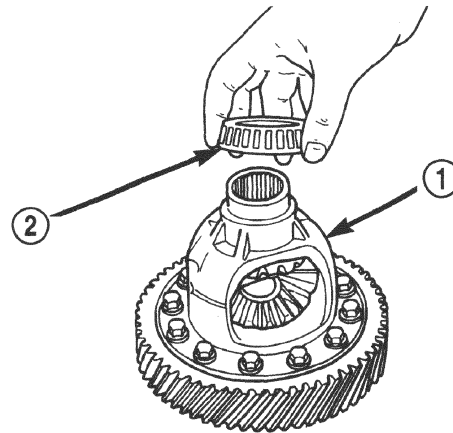
**Fig. 381 Checking Side Gear End Play (Bearing Retainer Side)**

- 1 - SPECIAL TOOL C-4996 (NOTE POSITION)
- 2 - DIAL INDICATOR SET
- 3 - DIFFERENTIAL ASSEMBLY

**ASSEMBLY**

**NOTE:** Use Mopar® Silicone Rubber Adhesive Sealant, or equivalent, on retainer and extension housing/adaptor plate to seal to case.

(1) Using Miller Special Tool L-4410, and C-4171, install differential bearing to differential (extension housing side) (Fig. 382).



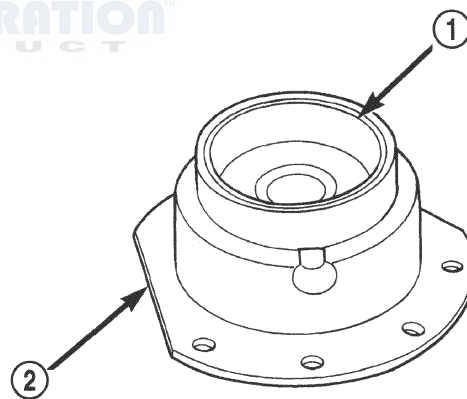
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**Fig. 382 Position Bearing Cone Onto Differential**

- 1 - DIFFERENTIAL ASSEMBLY
- 2 - DIFFERENTIAL BEARING

(2) Using Miller Special Tool 5052 and C-4171, install differential bearing to differential (bearing retainer side).

(3) Using Miller Special Tool 6061 and C-4171, install differential bearing race to bearing retainer (Fig. 383).



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**Fig. 383 Differential Bearing Retainer**

- 1 - DIFFERENTIAL BEARING CUP
- 2 - DIFFERENTIAL BEARING RETAINER

(4) Using Miller Special Tool L-4520 and C-4171, install differential bearing to extension housing.

**DIFFERENTIAL BEARING PRELOAD ADJUSTMENT**

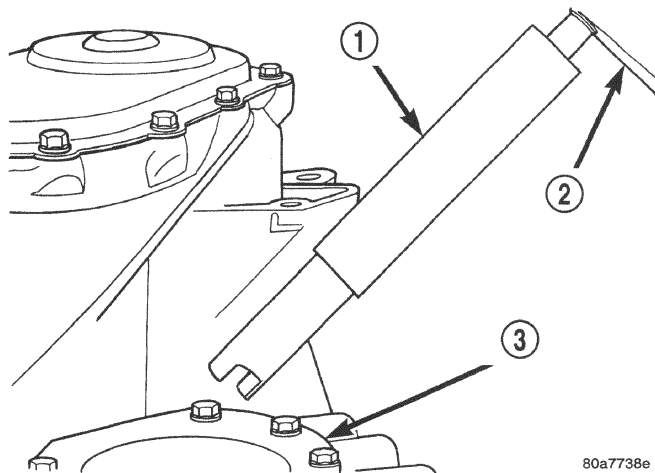
**NOTE:** Perform all differential bearing preload measurements with the transfer shaft and gear removed.



**DISASSEMBLY AND ASSEMBLY (Continued)****DIFFERENTIAL BEARING PRELOAD ADJUSTMENT USING EXISTING SHIM**

(1) Position the transaxle assembly vertically on the support stand, differential bearing retainer side up.

(2) Install Tool L-4436A into the differential and onto the pinion mate shaft (Fig. 384).



**Fig. 384 Tool L-4436 and Torque Wrench**

- 1 - SPECIAL TOOL L-4436-A
- 2 - TORQUE WRENCH
- 3 - DIFFERENTIAL BEARING RETAINER

(3) Rotate the differential at least one full revolution to ensure the tapered roller bearings are fully seated.

(4) Using Tool L-4436A and an inch-pound torque wrench, check the turning torque of the differential (Fig. 385). **The turning torque should be between 5 and 18 inch-pounds.**

(5) If the turning torque is within specifications, remove tools. Setup is complete.

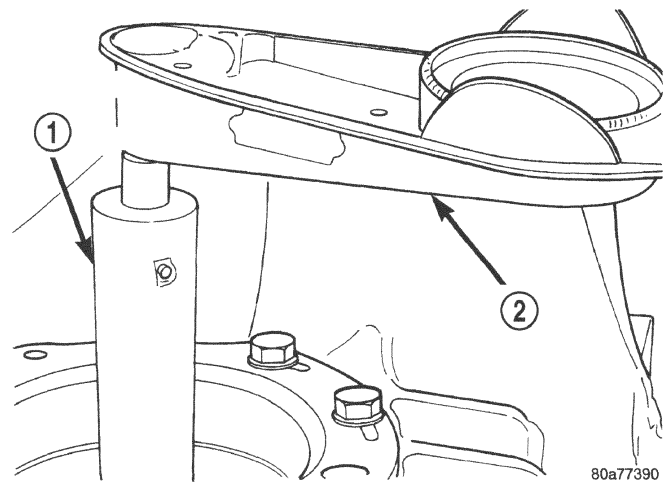
(6) If turning torque is not within specifications proceed with the following steps.

(a) Remove differential bearing retainer from the transaxle case.

(b) Remove the bearing cup from the differential bearing retainer using Tool 6062A.

(c) Remove the existing shim from under the cup.

(d) Measure the existing shim.



**Fig. 385 Checking Differential Bearings Turning Torque**

- 1 - SPECIAL TOOL L-4436-A
- 2 - TORQUE WRENCH

(e) If the turning torque was too high when measured, install a.05 mm (.002 inch) thinner shim. If the turning torque is was too low, install a.05 mm (.002 inch) thicker shim. Repeat until 5 to 18 inch-pounds turning torque is obtained. Oil Baffle is not required to be installed when making shim selection.

(f) Install the proper shim under the bearing cup. Make sure the oil baffle is installed properly in the bearing retainer, below the bearing shim and cup.

(g) Install the differential bearing retainer using Tool 5052 and C-4171. Seal the retainer to the housing with MOPAR® Adhesive Sealant and torque bolts to 28 N·m (250 in. lbs.).

(7) Using Tool L-4436A and an inch-pound torque wrench, recheck the turning torque of the differential (Fig. 385). **The turning torque should be between 5 and 18 inch-pounds.**

Shim thickness need be determined only if any of the following parts are replaced:

- Transaxle case
- Differential carrier
- Differential bearing retainer
- Extension housing
- Differential bearing cups and cones

**DISASSEMBLY AND ASSEMBLY (Continued)****DIFFERENTIAL BEARING SHIM CHART**

PART NUMBER	SHIM THICKNESS	
	MM	INCH
4659257	.980	0.0386
4659258	1.02	0.0402
4659259	1.06	0.0418
4659260	1.10	0.0434
4659261	1.14	0.0449
4659262	1.18	0.0465
4659263	1.22	0.0481
4659264	1.26	0.0497
4659265	1.30	0.0512
4659266	1.34	0.0528
4659267	1.38	0.0544
4659268	1.42	0.0560
4659269	1.46	0.0575
4659270	1.50	0.0591
4659271	1.54	0.0607
4659272	1.58	0.0623
4659273	1.62	0.0638
4659274	1.66	0.0654
4659275	1.70	0.0670
4659283	2.02	0.0796
4659284	2.06	0.0812

**PRELOAD ADJUSTMENT W/O SHIM**

(1) Remove the bearing cup from the differential bearing retainer using Miller special Tool 6062A.

(2) Remove existing shim from under bearing cup.

(3) Reinstall the bearing cup into the retainer using Miller Special Tool 6061, and C-4171.

**NOTE: Oil baffle is not required when making the shim calculation.**

(4) Install the bearing retainer into the case. Torque bolts to 28 N•m (250 in. lbs.).

(5) Position the transaxle assembly vertically on the support stand and install Miller Special Tool L-4436-A into the bearing retainer.

(6) Rotate the differential at least one full revolution to ensure the tapered roller bearings are fully seated.

(7) Attach a dial indicator to the case and zero the dial. Place the tip on the end of Special Tool L-4436-A.

(8) Place a large screwdriver to each side of the ring gear and lift. Check the dial indicator for the amount of end play.

**CAUTION: Do not damage the transaxle case and/or differential retainer sealing surface.**

(9) Using the end play measurement that was determined, add .18mm (.007 inch). This should give you between 5 and 18 inch pounds of bearing preload. Refer to the Differential Bearing Shim Chart to determine which shim to use.

(10) Remove the differential bearing retainer. Remove the bearing cup.

(11) Install the oil baffle. Install the proper shim combination under the bearing cup.

(12) Install the differential bearing retainer. Seal the retainer to the housing with Mopar® Silicone Rubber Adhesive Sealant. Torque bolts to 28 N•m (250 in. lbs.).

(13) Using Miller Special Tool L-4436-A and an inch-pound torque wrench, check the turning torque of the differential (Fig. 385). The turning torque should be between 5-18 inch-pounds.

## DISASSEMBLY AND ASSEMBLY (Continued)

**NOTE:** If turning torque is too high install a .05mm (.002 inch) thicker shim. If the turning torque is too low, install a .05mm (.002 inch) thinner shim. Repeat until 5-18 inch-pounds of turning torque is obtained.

## CLEANING AND INSPECTION

### CLEANING VALVE BODY

Prior to removing any transaxle parts, plug all openings and clean unit, preferably by steam. Cleanliness through entire disassembly and assembly cannot be overemphasized. When disassembling, each part should be washed in a suitable solvent, then dried by compressed air. **Do not wipe parts with shop towels.** All mating surfaces in the transaxles are accurately machined; therefore, careful handling of all parts must be exercised to avoid nicks or burrs.

**NOTE:** Tag all springs, as they are removed, for reassembly identification.

## ADJUSTMENTS

### GEARSHIFT LINKAGE ADJUSTMENT

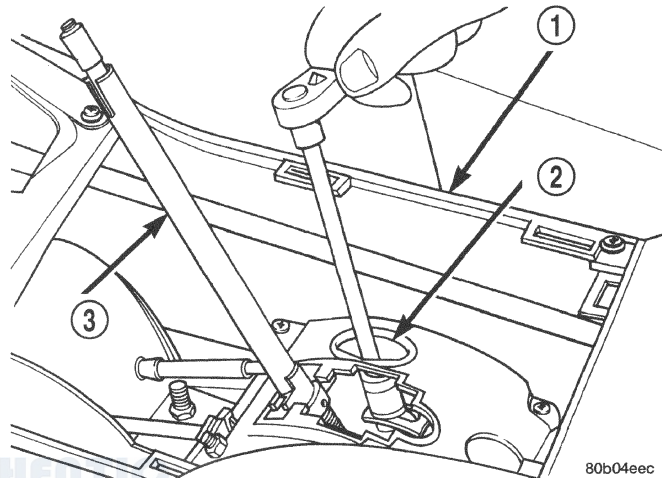
Normal operation of the Park/Neutral Position Switch provides a quick check to confirm proper linkage adjustment.

Move the selector level slowly forward until it clicks into the (P) Park position. The starter should operate.

After checking the (P) position, move selector slowly toward the (N) Neutral position until lever is in the (N) position. If the starter will also operate at this point the gearshift linkage is properly adjusted. If the starter fails to operate in either position, linkage adjustment is required.

### ADJUSTMENT

- (1) Set parking brake.
- (2) Remove the gearshift knob set screw and knob.
- (3) Remove gearshift selector bezel and lamp wiring.
- (4) Install the gearshift knob set screw and knob.
- (5) Place gearshift lever in the (P) (PARK) position.
- (6) Loosen the gearshift cable adjuster nut at the shifter assembly (Fig. 386).



**Fig. 386 Shift Cable Adjust Lever Nut**

- 1 - CONSOLE
- 2 - ACCESS HOLE
- 3 - SHIFTER HANDLE

(7) Move the gearshift lever on the transaxle to the park position.

(8) Verify the shift lever and transaxle are in park position. Tighten the gearshift cable adjuster nut at the shifter assembly. The gearshift linkage should now be properly adjusted.

(9) Check adjustment as follows:

- Detent position for neutral and drive should be within limits of hand lever gate stops.
- Key start must occur only when shift lever is in park or neutral positions.

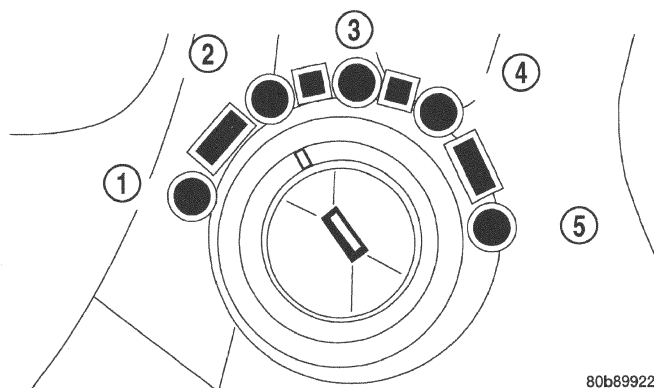


## ADJUSTMENTS (Continued)

### BRAKE/TRANSMISSION SHIFT INTERLOCK

#### VERIFICATION

The following chart describes the normal operation of the Brake Transmission Shift Interlock (BTSI) system. If the "expected response" differs from the vehicle's response, then system repair and/or adjustment is necessary. Refer to the following chart that expected shifter response, depending on ignition key/switch (Fig. 387) and brake pedal positions.



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**Fig. 387 Ignition Key/Switch Positions**

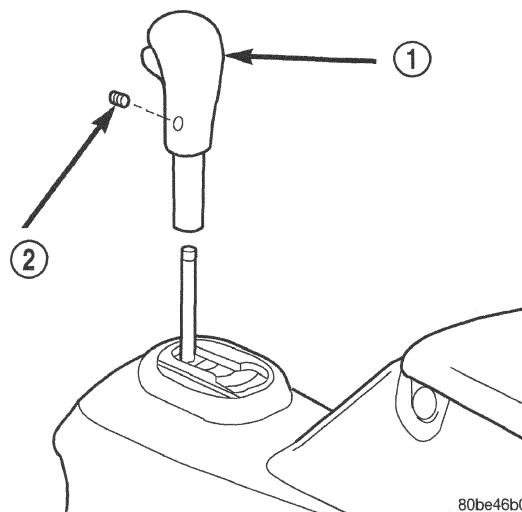
- 1 - ACC
- 2 - LOCK
- 3 - OFF
- 4 - ON/RUN
- 5 - START

ACTION	EXPECTED RESPONSE
1. Turn key to the "OFF" position.	1. Shifter CAN be shifted out of park.
2. Turn key to the "ON/RUN" position.	2. Shifter CANNOT be shifted out of park.
3. Turn key to the "ON/RUN" position and depress the brake pedal.	3. Shifter CAN be shifted out of park.
4. Leave shifter in any gear and try to return key to the "LOCK" or "ACC" position.	4. Key cannot be returned to the "LOCK" or "ACC" position.
5. Return shifter to "PARK" and try to remove the key.	5. Key can be removed (after returning to "LOCK" position).
6. With the key removed, try to shift out of "PARK".	6. Shifter cannot be shifted out of "PARK".
<b>NOTE: Any failure to meet these expected responses requires system adjustment or repair.</b>	

#### ADJUSTMENT

(1) Disconnect and isolate, the battery negative cable.

(2) Remove the gearshift knob set screw and knob (Fig. 388).



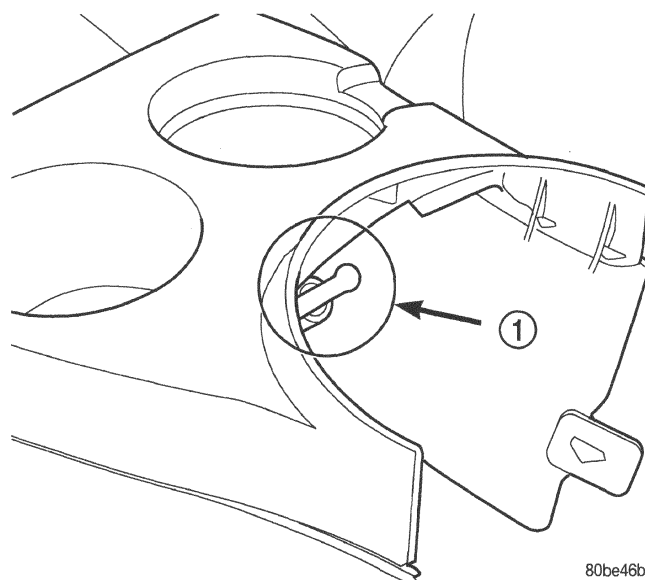
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**Fig. 388 Shifter Knob Removal/Installation**

- 1 - SHIFTER KNOB
- 2 - SET SCREW

(3) Remove the floor console (rear). Refer to Group 23, Body for the proper procedures.

**CAUTION:** When removing forward console, the console will contact nylon shift release plunger (Fig. 389). If care is not used, plunger may break, requiring shifter assembly replacement.



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**Fig. 389 Console/Shifter Contact Area**

- 1 - AREA OF CONTACT



**ADJUSTMENTS (Continued)**

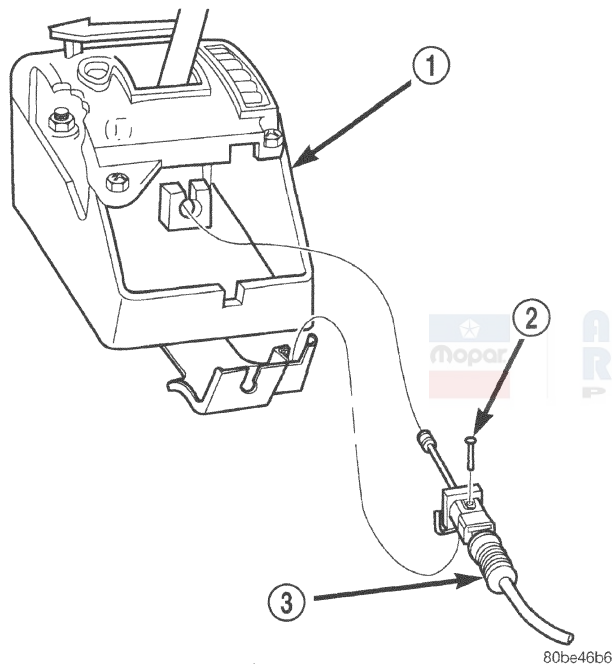
(4) Remove the forward IP console (front). Refer to Group 23, Body for the proper procedures.

(5) Re-install the gearshift knob set screw and knob (Fig. 388).

(6) Place the shift lever in PARK. Move the Ignition key to the LOCK position (Fig. 387) and remove the key.

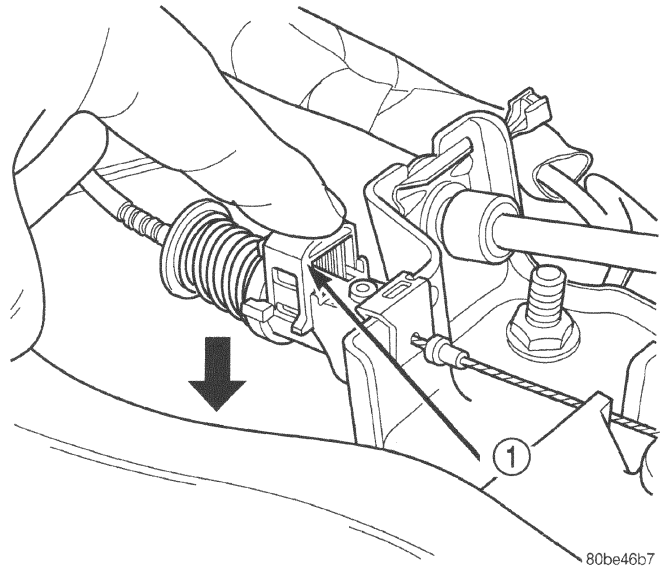
(7) If the interlock cable is being replaced, remove the lock pin (Fig. 390). This will allow the cable to "self adjust" to the correct position. Tighten the locking clip by pushing it down (Fig. 391).

(8) If the interlock cable **is not** being replaced, the lock pin will not exist. Pull outward on cable locking clip to allow cable to self adjust. Press clip down to lock in place (Fig. 391).



**Fig. 390 Interlock Cable Locking Pin**

- 1 - SHIFTER ASSEMBLY
- 2 - LOCKING PIN
- 3 - INTERLOCK CABLE



**Fig. 391 Locking Clip**

- 1 - LOCKING CLIP

(9) Verify Brake/Transmission Shift Interlock system operation. Refer to operation chart in "Verification."

**CAUTION:** When installing forward console, the console will contact nylon shift release plunger (Fig. 389). If care is not used, plunger may break, requiring shifter assembly replacement.

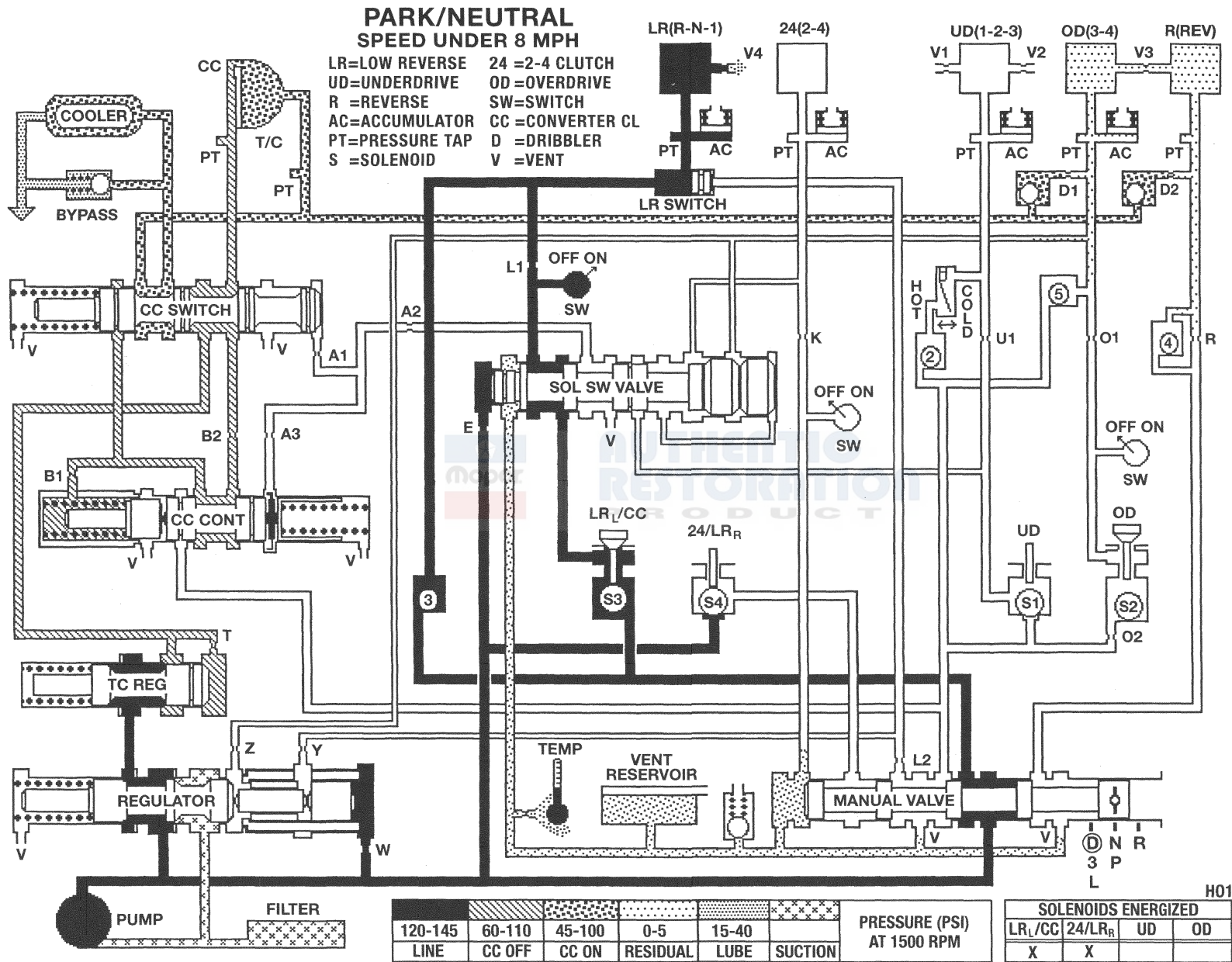
(10) Install the forward IP console (front). Refer to Group 23, Body for the proper procedures.

(11) Install the floor console (rear) and shift indicator bezel. Refer to Group 23, Body for the proper procedures.

(12) Install the gearshift knob and tighten set screw (Fig. 388) to 2 N·m (20 in.lbs.).

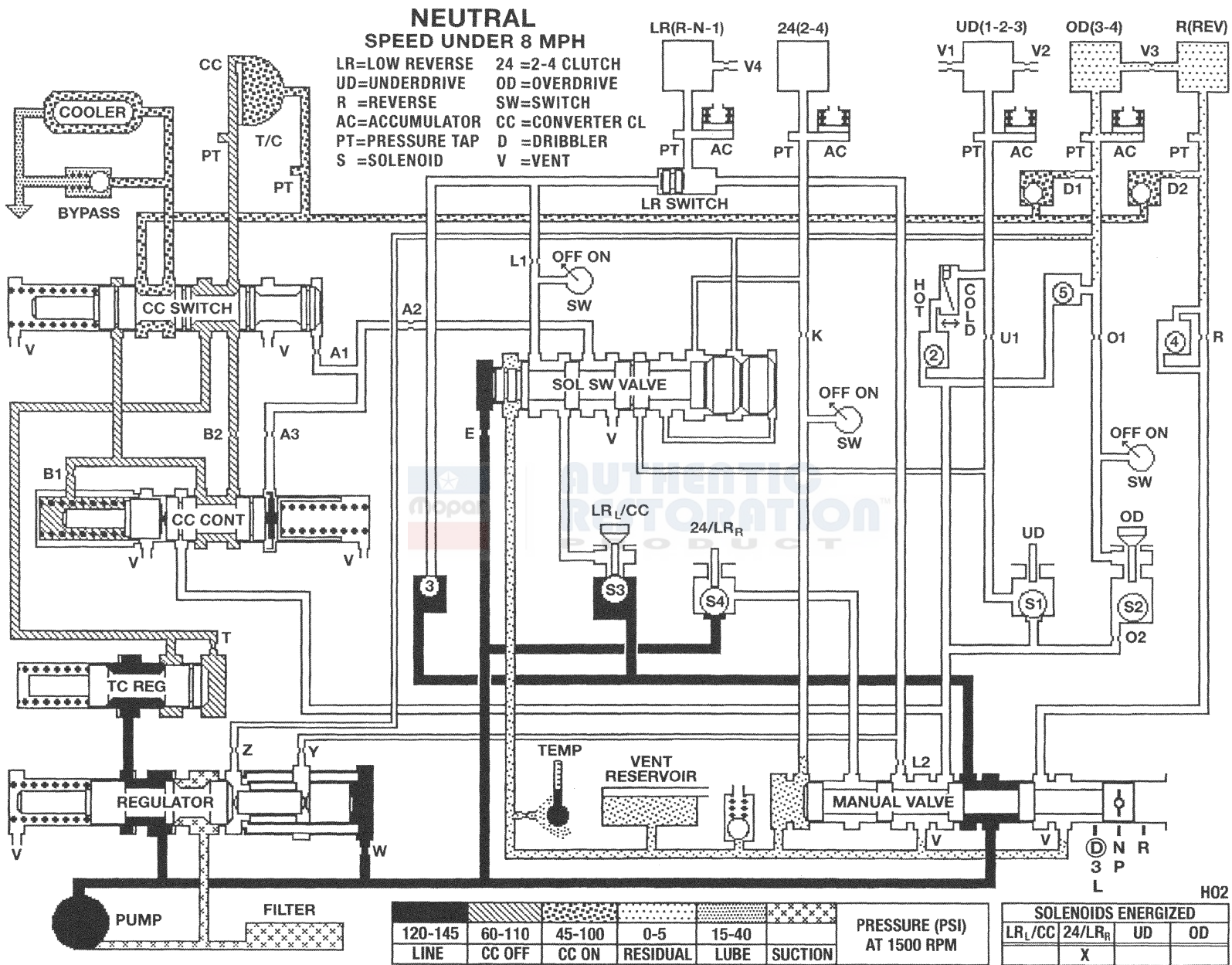
(13) Connect the battery negative cable.

# **SCHEMATICS AND DIAGRAMS** **41TE TRANSAXLE HYDRAULIC SCHEMATICS**



41TE TRANSAXLE HYDRAULIC SCHEMATIC

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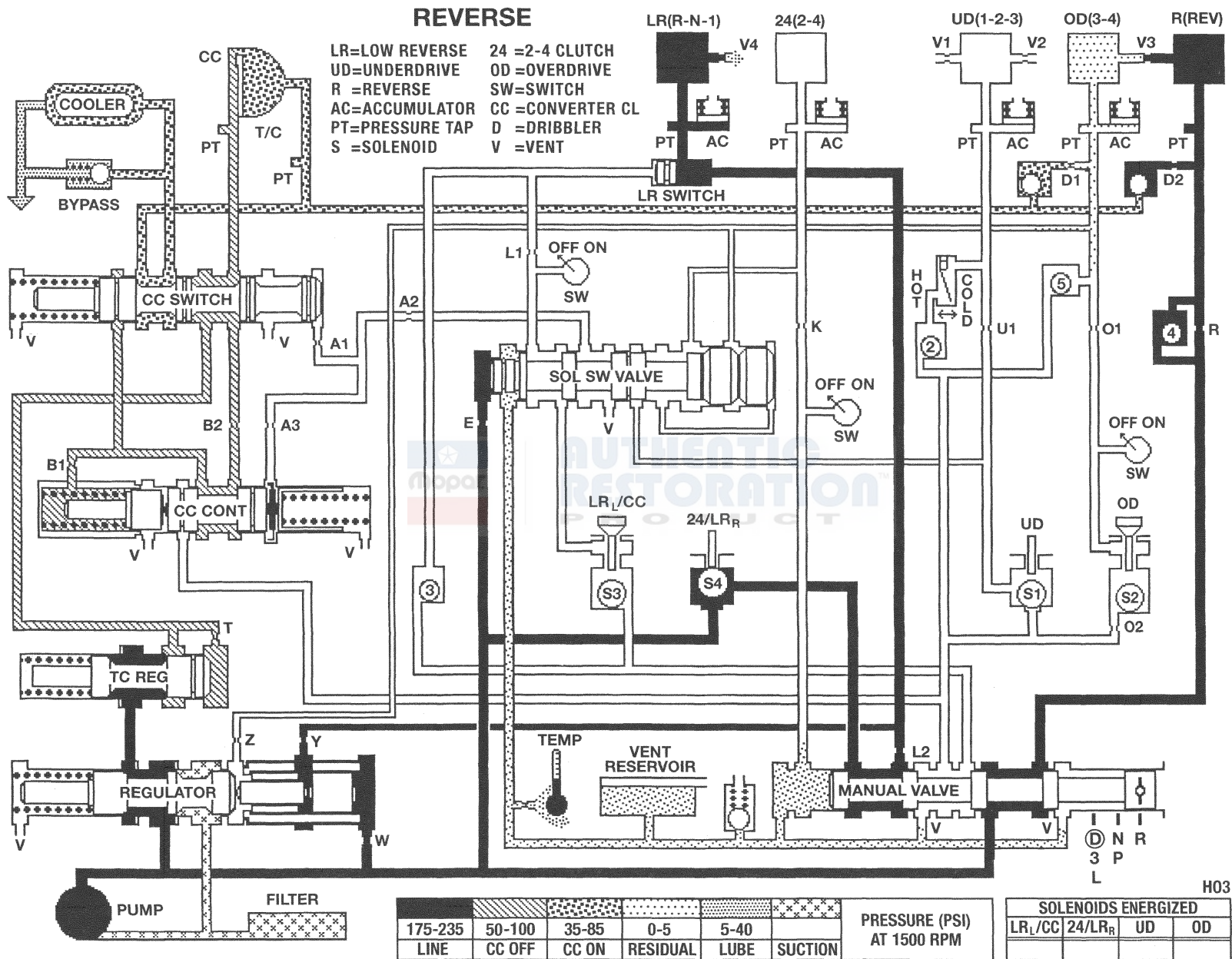


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41TE TRANSAXLE HYDRAULIC SCHEMATIC



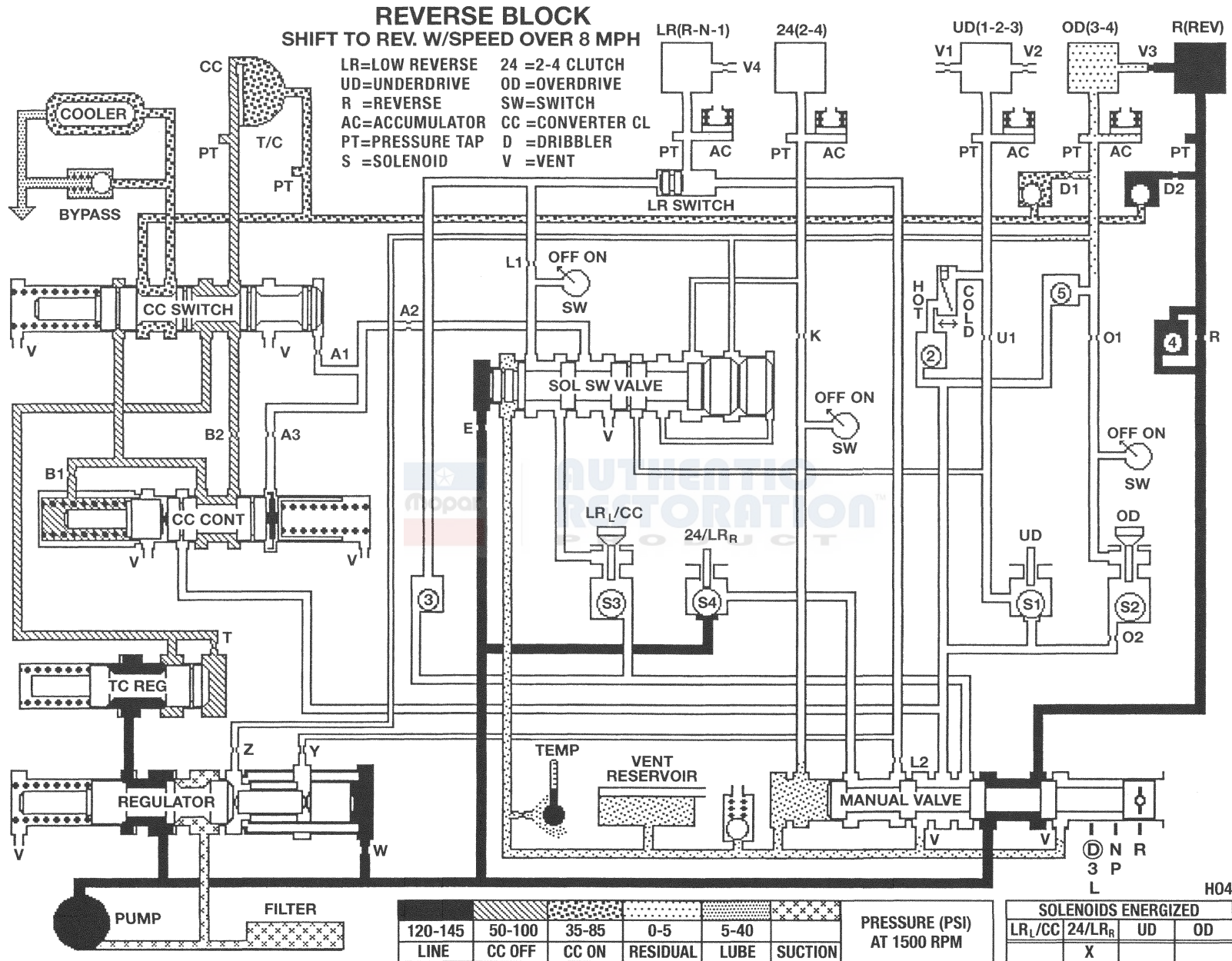
SCHEMATICS AND DIAGRAMS (Continued)



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41TE TRANSA XLE HYDRAULIC SCHEMATIC

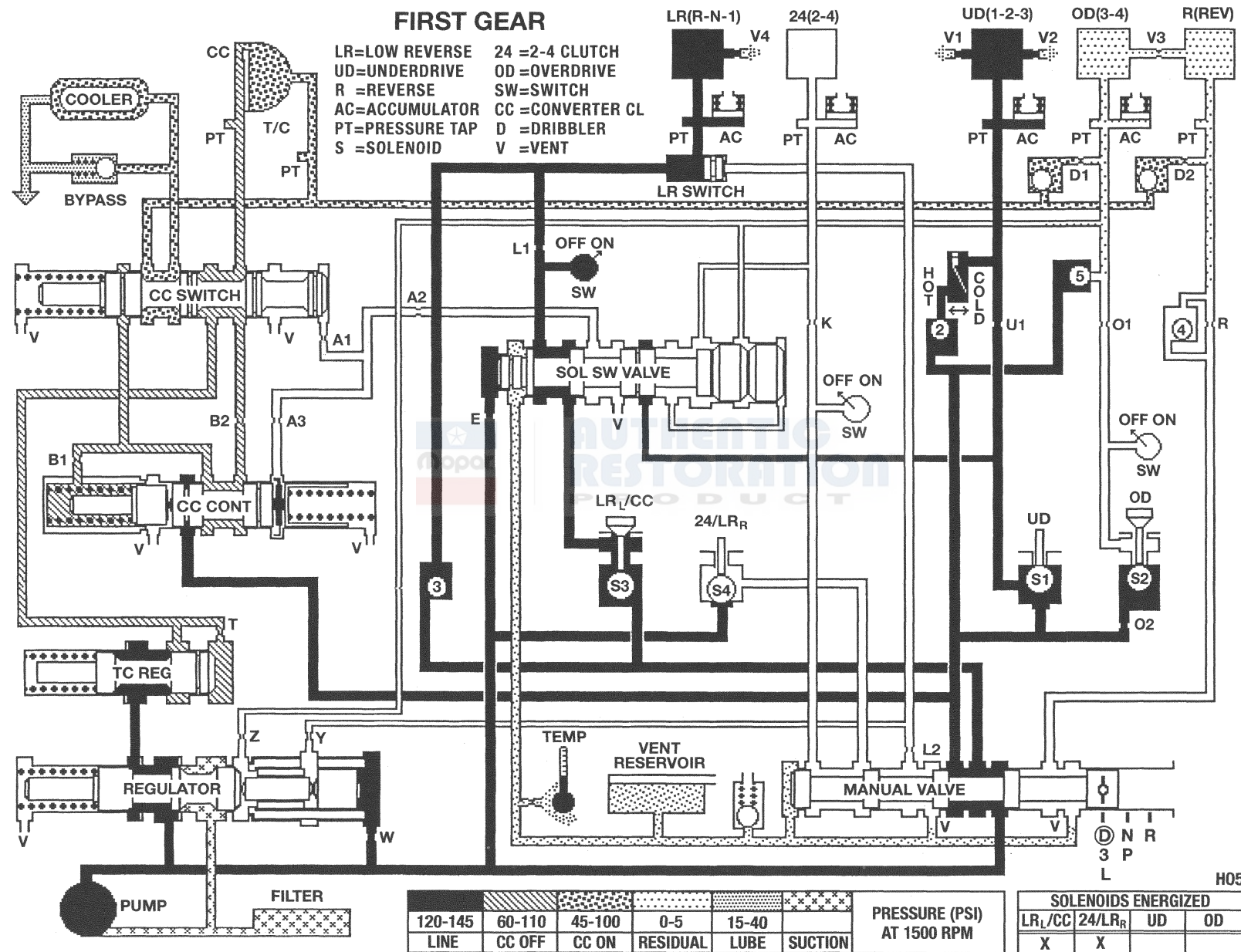




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41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)

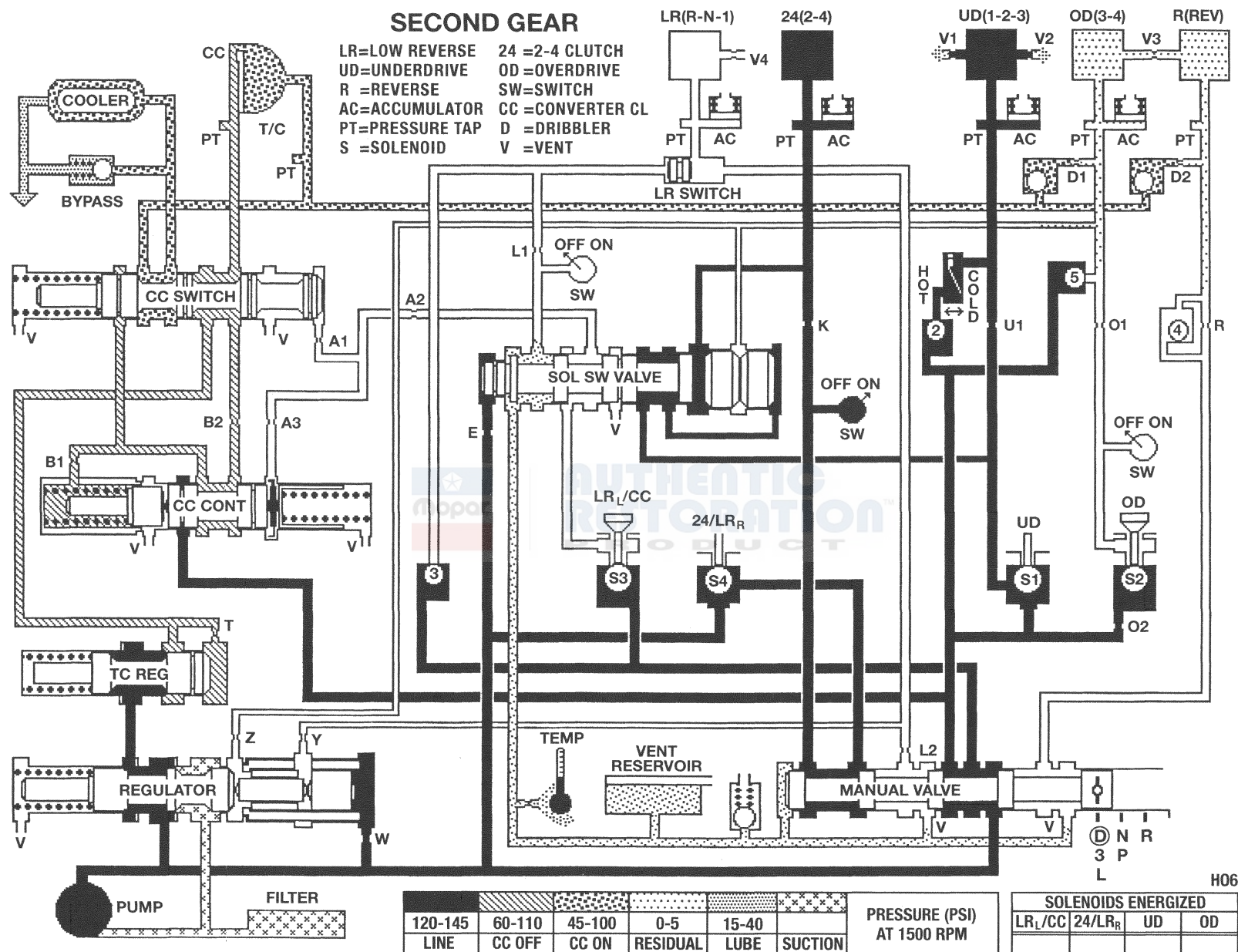


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41TE TRANSAXLE HYDRAULIC SCHEMATIC



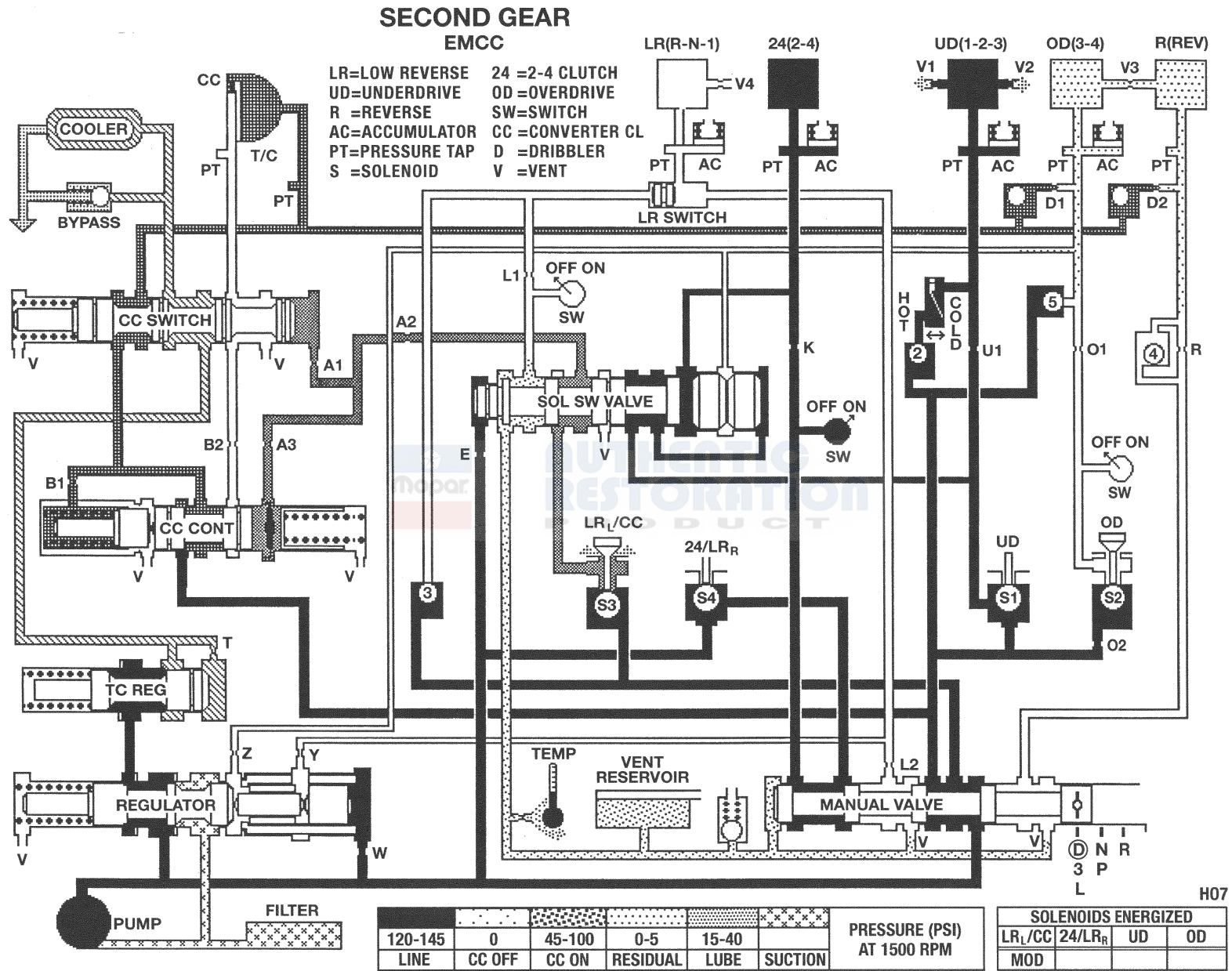
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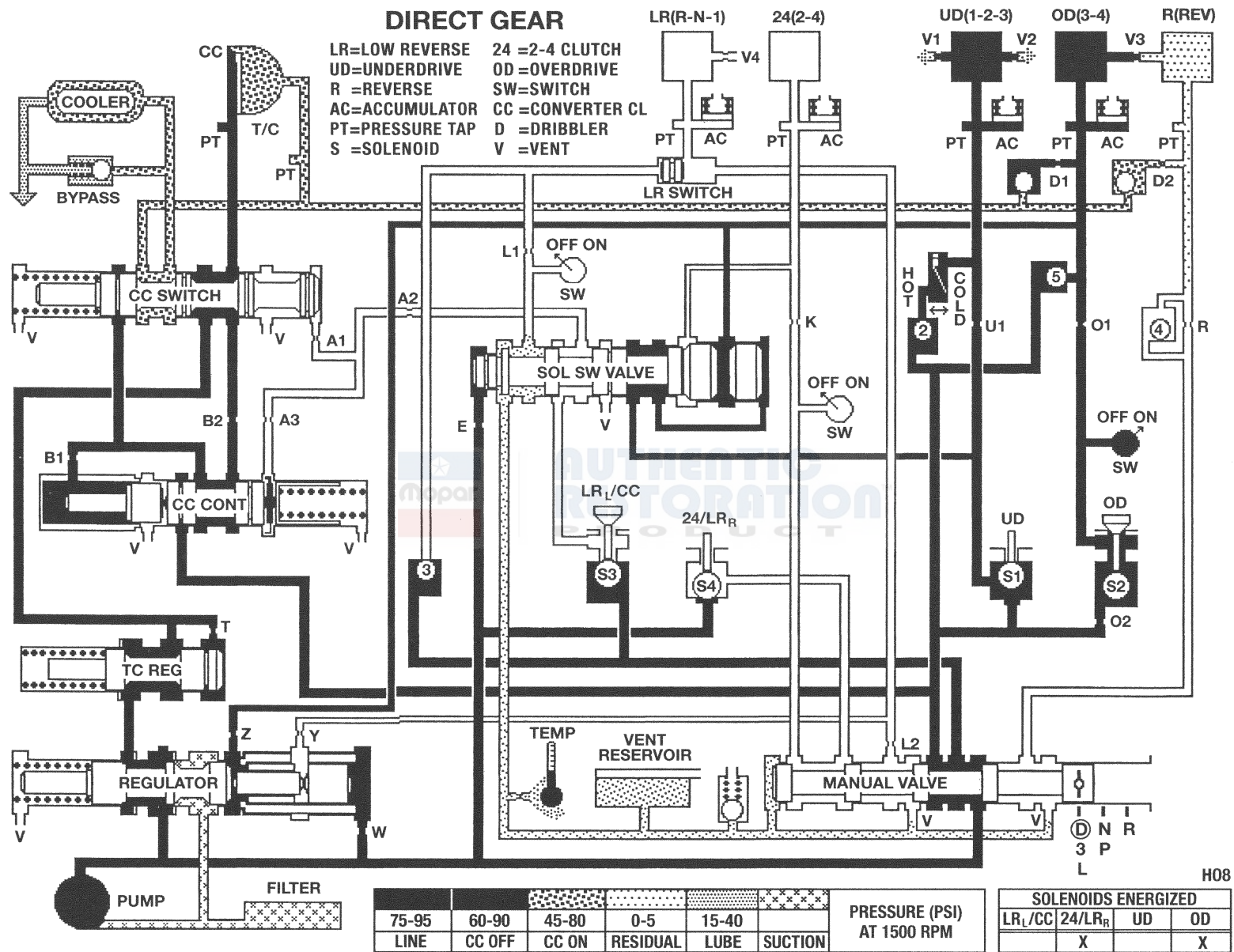
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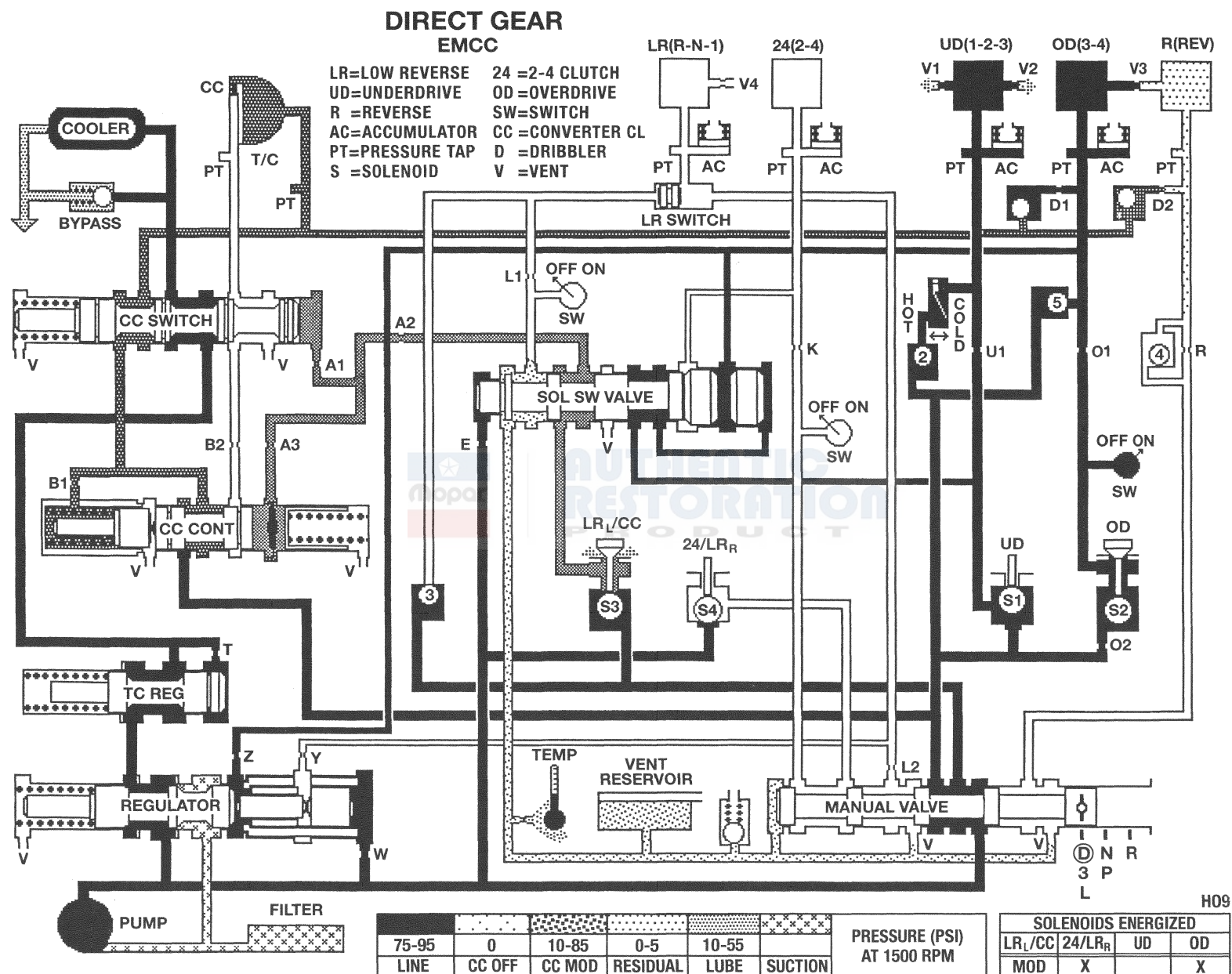




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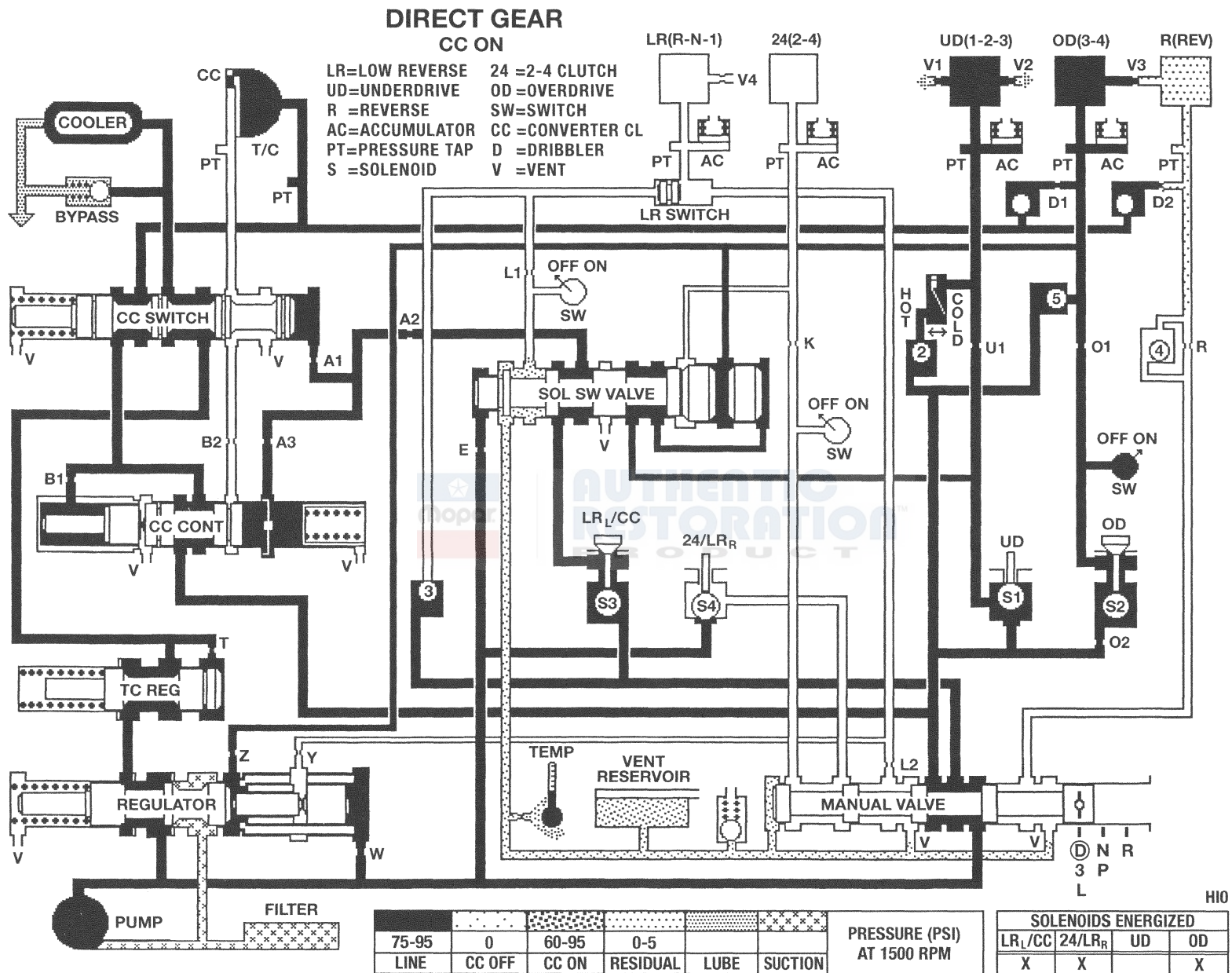
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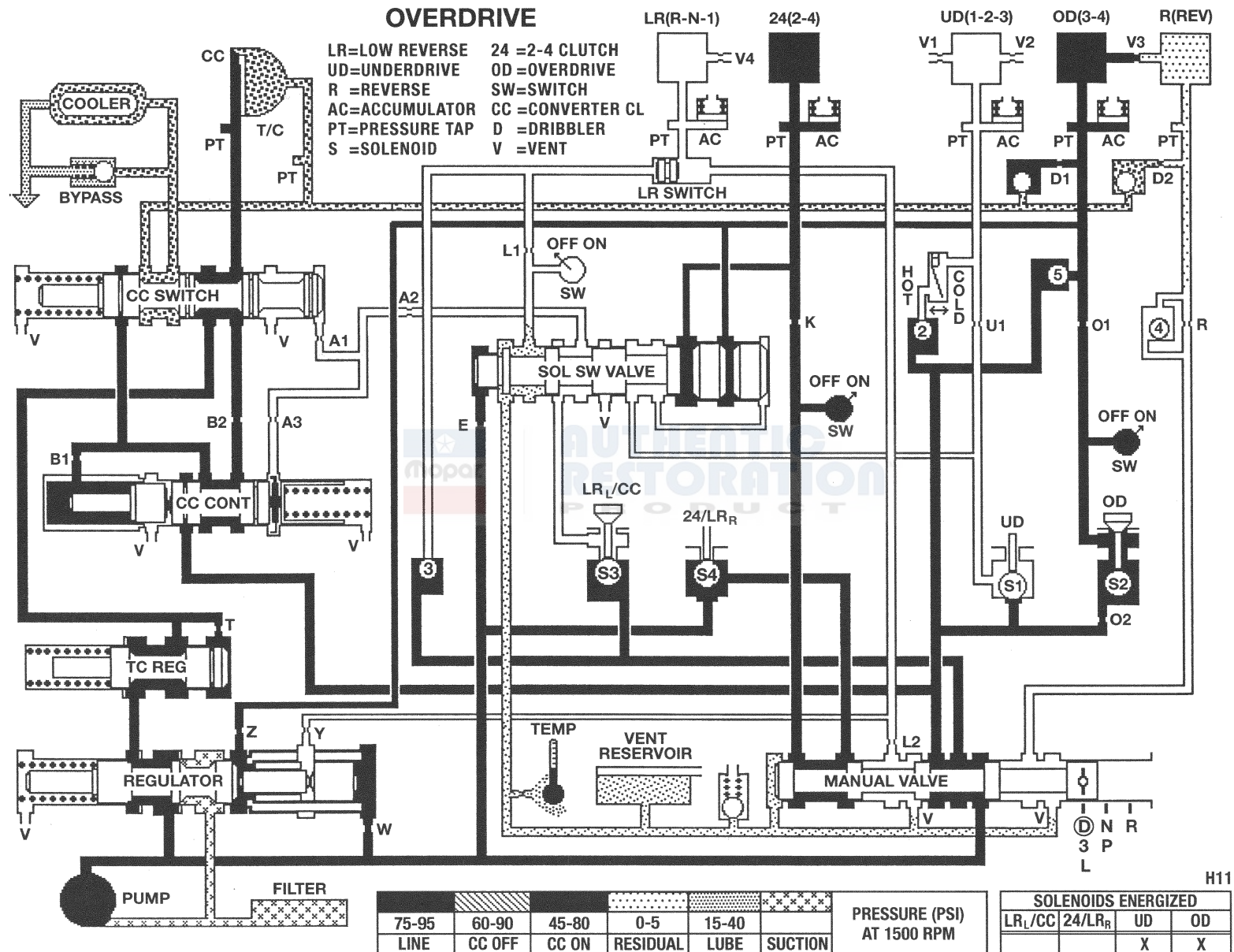


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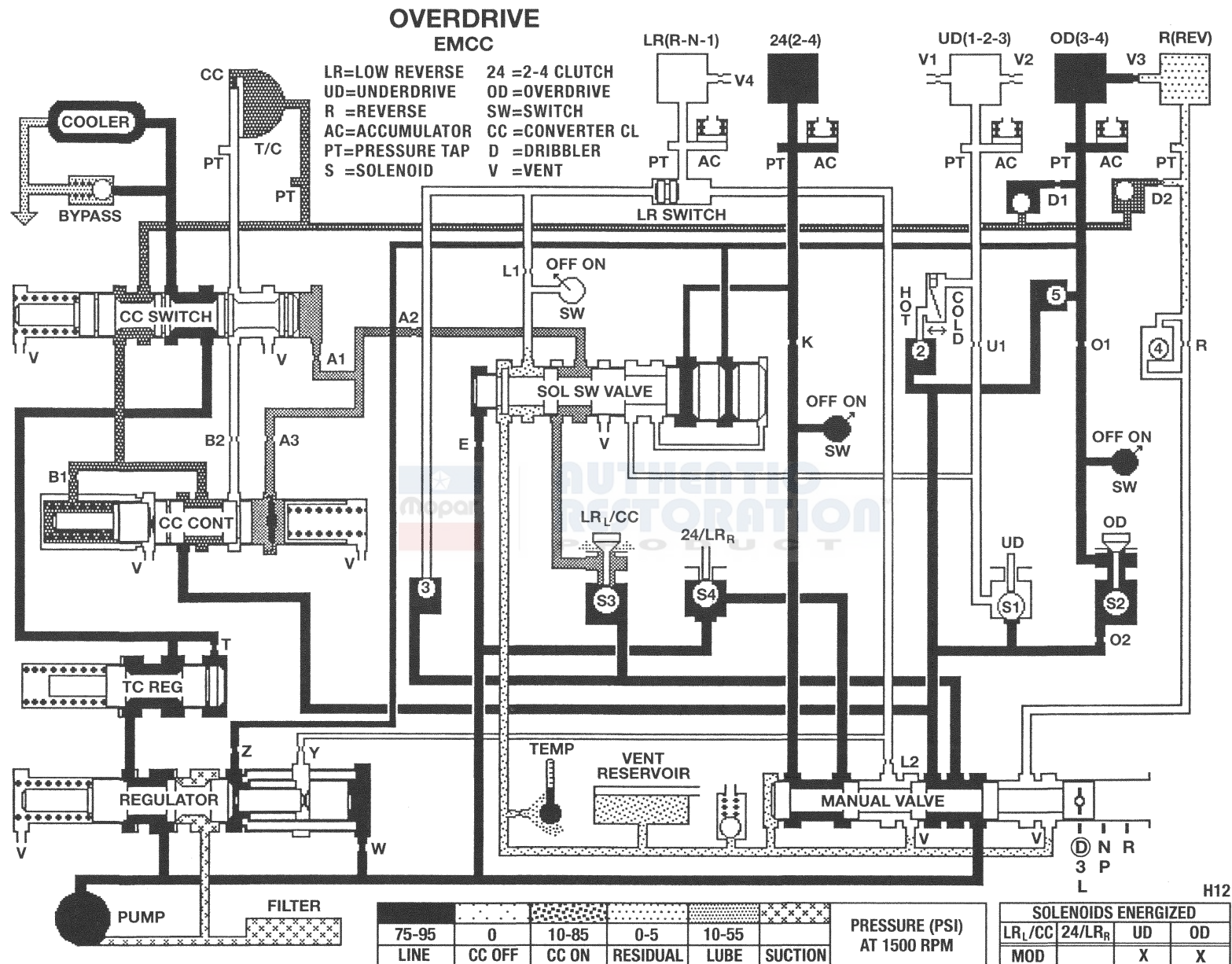
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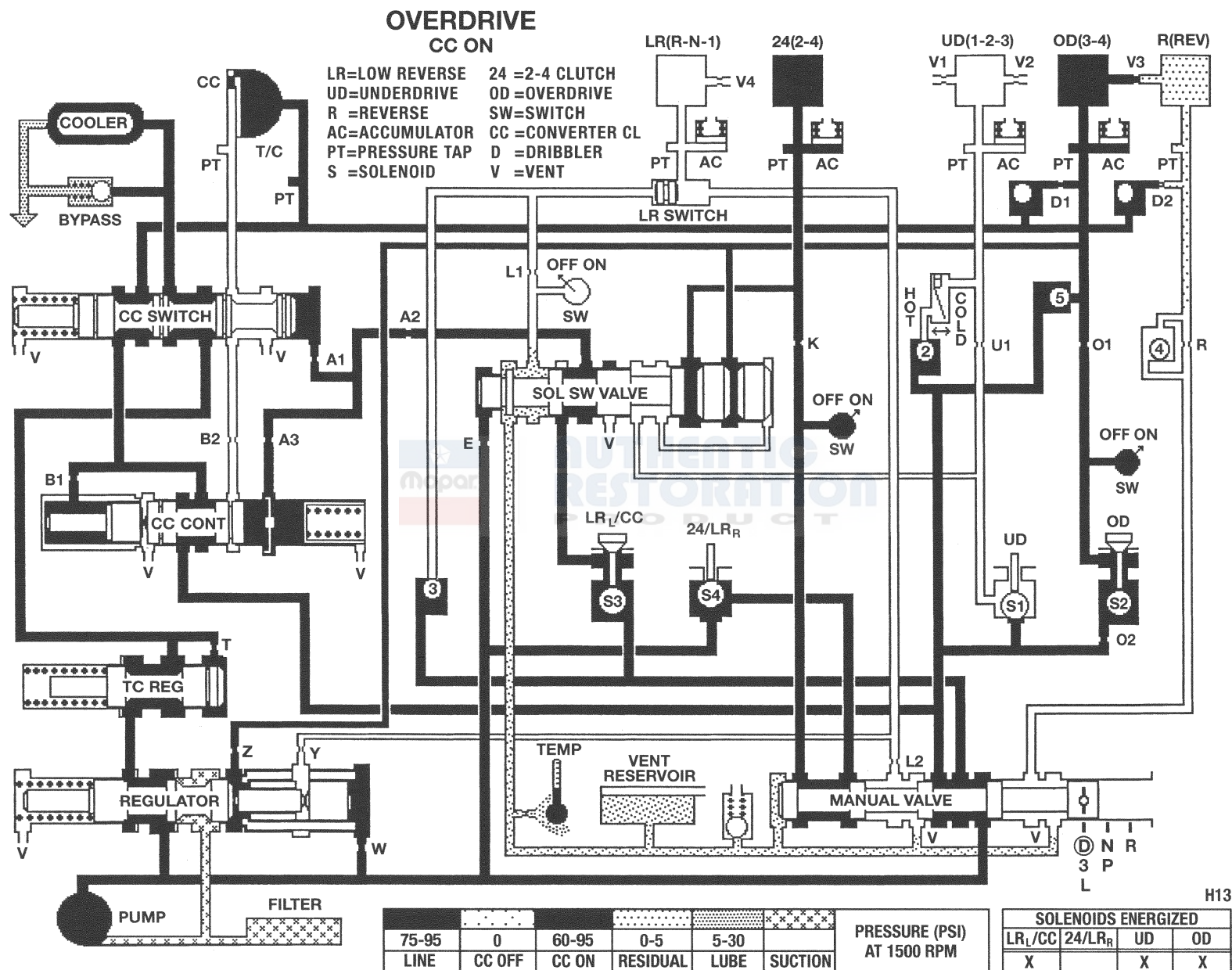




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41TE TRANSAXLE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



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41TE TRANSAXLE HYDRAULIC SCHEMATIC

## SPECIFICATIONS

### 41TE AUTOMATIC TRANSAXLE

Type . Fully adaptive, electronically controlled, four speed automatic with torque converter and integral differential

Torque Converter Diameter . . . . . 241 millimeters (9.48 in.)

Oil Capacity . . . . . 8.6 Liters (18.25 pints)

Oil Type . . . . . Mopar® ATF+4 Type 9602

Cooling Method . Water Heat Exchanger and/or air to oil heat exchanger

Lubrication . . . . . Pump (internal-external gear-type)

#### Gear Ratios

##### Transmission

First Gear . . . . . 2.84

Second Gear . . . . . 1.57

Direct Gear . . . . . 1.00

Overdrive Gear . . . . . 0.69

Reverse Gear . . . . . 2.21

#### Overall Top Gear Ratio

2.5 Liter . . . . . 2.69

#### Bearing Preload

Differential Assembly . 5 to 18 in. lbs. Drag Torque

Output Hub . . . . . 3 to 8 in. lbs. Drag Torque

Transfer Shaft . . . . . 0.002 to 0.004 in. End Play

Overall Drag At Output Hub . . . . . 3 to 16 in. lbs. Drag Torque

#### Clutch Pack Clearances

##### Low/Rev Clutch

(Select Reaction Plate) . . . . . 0.86-1.52 mm (0.034-0.060 in.)

Two/Four Clutch (No Selection) . . . . . 0.76-2.64 mm (0.030-0.104 in.)

Reverse Clutch (Select Snap Ring) . . 0.89-1.37 mm (0.035-0.054 in.)

Overdrive Clutch (No Selection) . . . . 1.07-3.25 mm (0.042-0.128 in.)

##### Underdrive Clutch

(Select Pressure Plate) . . . . . 0.94-1.50 mm (0.037-0.059 in.)

Input Shaft End Play . . . . . 0.12-0.63 mm (0.005-0.025 in.)

#### Input Shaft

End Play . . . . . 0.127-0.635mm (0.005-0.025 in.)

#### Pump Clearances

Outer Gear To Pocket . . . . . 0.045-0.141 mm (0.0018-0.0056 in.)

Outer Gear Side Clearance . . . . . 0.020-0.046 mm (0.0008-0.0018 in.)

Inner Gear Side Clearance . . . . . 0.020-0.046 mm (0.0008-0.0018 in.)

### 41TE TORQUE SPECIFICATIONS

#### DESCRIPTION

#### TORQUE

Cooler Line Fittings . . . . . 12 N·m (105 in. lbs.)

Differential Cover . . . . . 19 N·m (165 in. lbs.)

Differential Ring Gear . . . . . 95 N·m (70 ft. lbs.)

Differential Bearing Ret. . . . . 28 N·m (21 ft. lbs.)

Driveplate To Crank. Bolts . . . . 95 N·m (70 ft. lbs.)

Driveplate To Torque Conv. . . . . 75 N·m (55 ft. lbs.)

Eight Way Solenoid Conn. . . . . 4 N·m (35 in. lbs.)

Extension Housing . . . . . 28 N·m (21 ft. lbs.)

Input Speed Sensor . . . . . 27 N·m (20 ft. lbs.)

L/R Clutch Retainer . . . . . 5 N·m (45 in. lbs.)

Oil Pan To Trans. Case . . . . . 19 N·m (165 in. lbs.)

Output Gear Bolt . . . . . 271 N·m (200 ft. lbs.)

Output Gear Stirrup Ret. . . . . 23 N·m (17 ft. lbs.)

Output Speed Sensor . . . . . 27 N·m (20 ft. lbs.)

Pressure Taps . . . . . 5 N·m (45 in. lbs.)

Pump To Case Bolts . . . . . 27 N·m (20 ft. lbs.)

Reaction Shaft Bolts . . . . . 27 N·m (20 ft. lbs.)

Rear End Cover . . . . . 20 N·m (125 in. lbs.)

Sixty-Way Connector . . . . . 4 N·m (35 in. lbs.)

Solenoid Assembly To Case . . . . 12 N·m (110 in. lbs.)

Transmission Range Sensor . . . . . 5 N·m (45 in. lbs.)

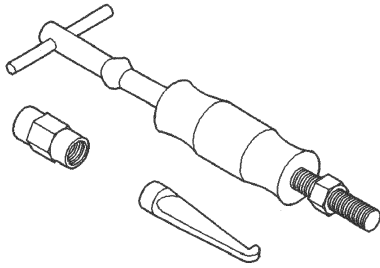
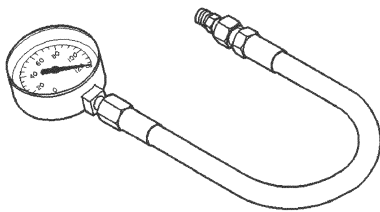
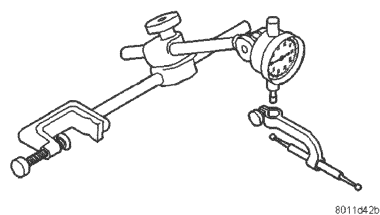
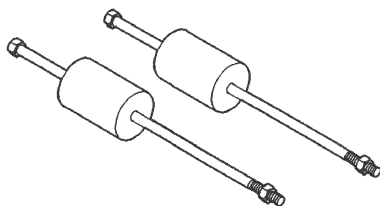
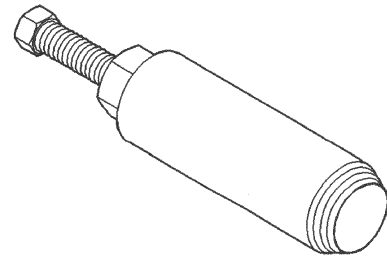
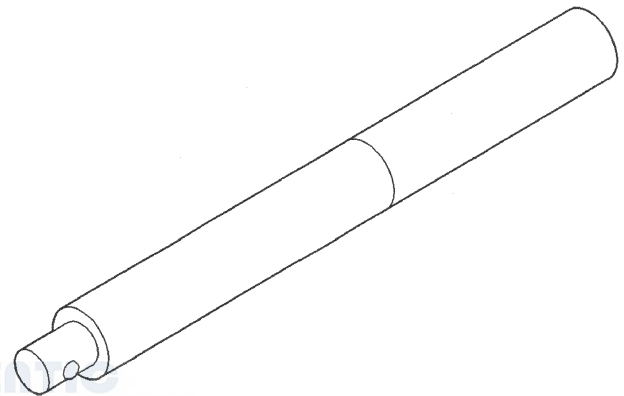
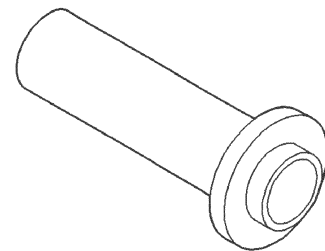
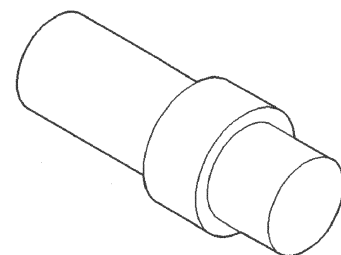
Transfer Gear Nut . . . . . 271 N·m (200 ft. lbs.)

Transfer Plate To Case . . . . . 12 N·m (105 in. lbs.)

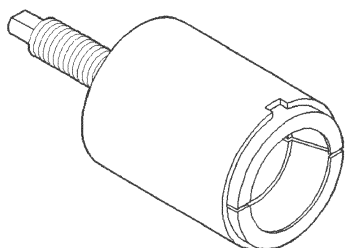
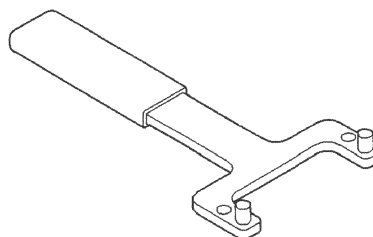
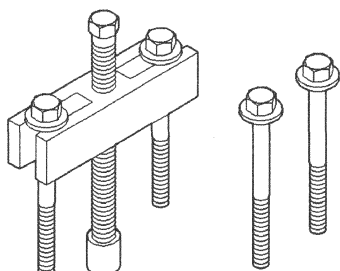
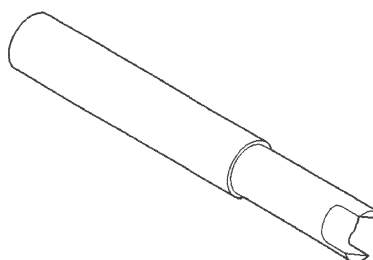
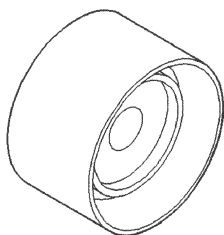
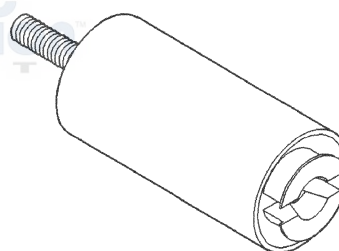
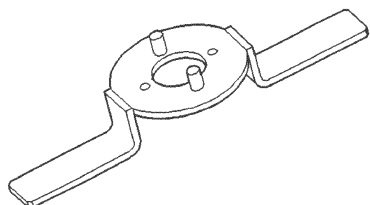
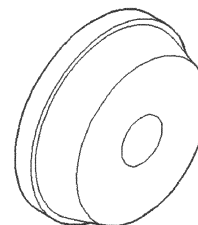
Valve Body To Case Bolts . . . . . 12 N·m (105 in. lbs.)

Valve Body Bolts . . . . . 5 N·m (45 in. lbs.)

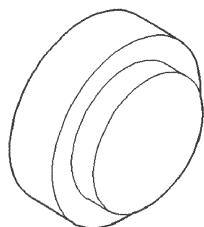
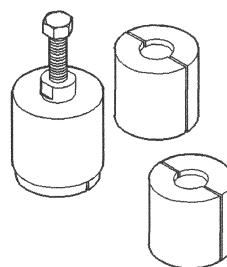
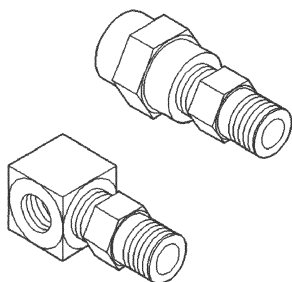
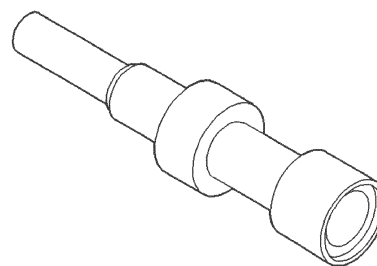
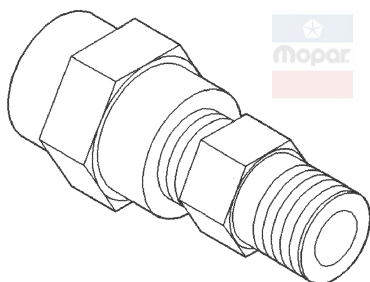
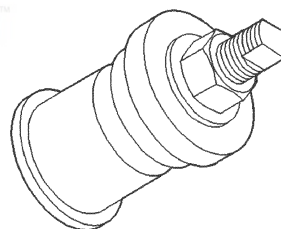
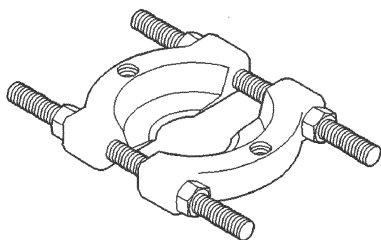
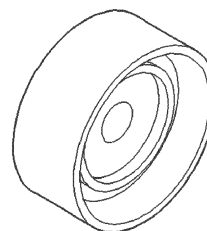
Vent Assembly . . . . . 12 N·m (105 in. lbs.)

**SPECIAL TOOLS****41TE AUTOMATIC TRANSAXLE****Puller C-637****Pressure Gauge (High) C-3293SP****Dial Indicator C-3339****Oil Pump Puller C-3752****Seal Puller C-3981B****Universal Handle C-4171****Seal Installer C-4193A****Adapter C-4996**

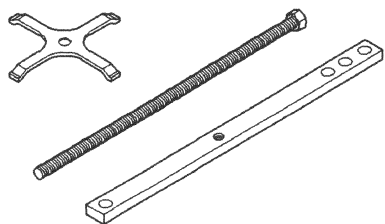
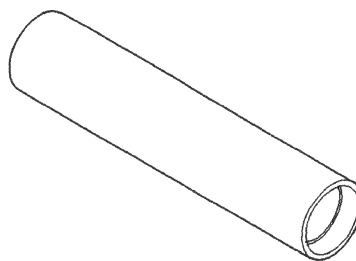
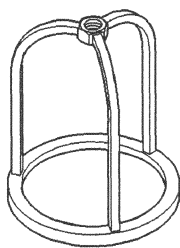
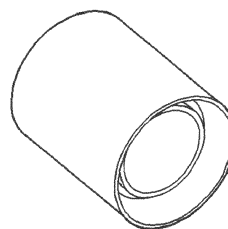
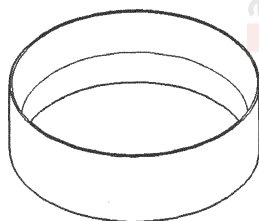


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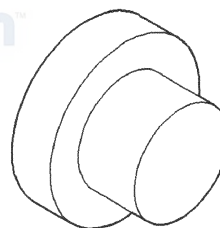
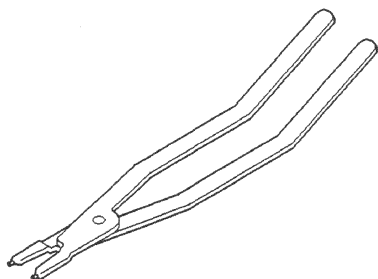
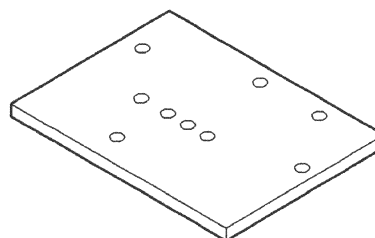
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PRODUCT**

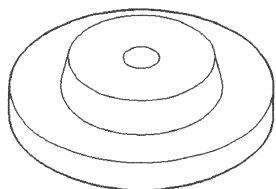
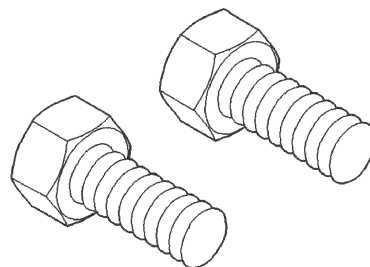
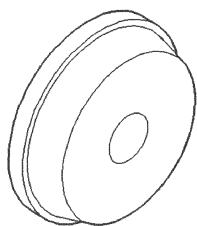
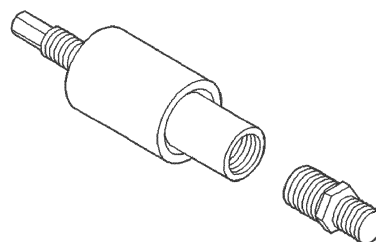
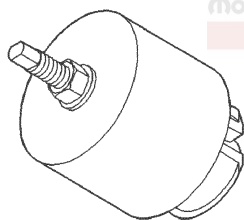
**SPECIAL TOOLS (Continued)****Thrust Button L-4539-2****Puller Set 5048****Adapter Set L-4559****Remover/Installer 5049-A****Fig. 392 Adapter L-4559-2****Installer 5050A****Bearing Splitter P-334****Installer 5052**

**AUTHENTIC  
RESTORATION<sup>™</sup>  
PRODUCT**

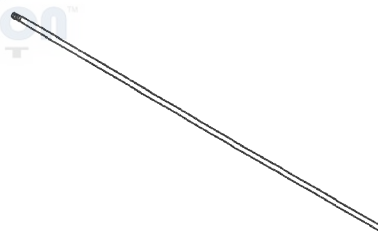
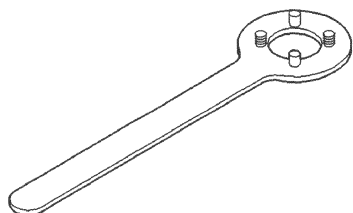
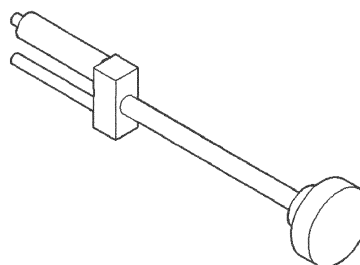
**SPECIAL TOOLS (Continued)****Compressor 5058A****Installer 6052****Compressor 5059-A****Installer 6053****Installer 5067**

**AUTHENTIC  
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PRODUCT**

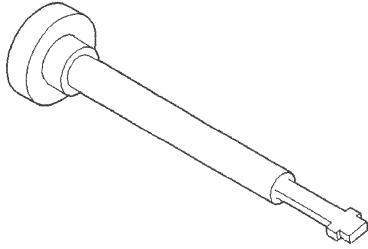
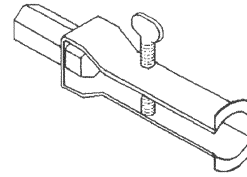
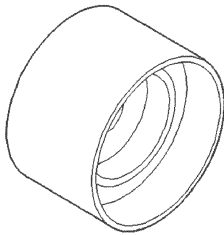
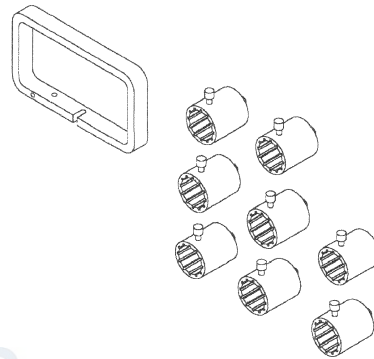
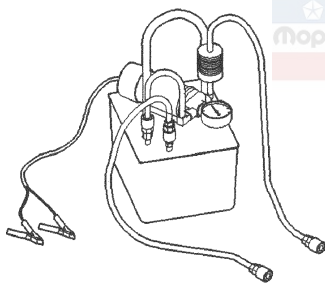
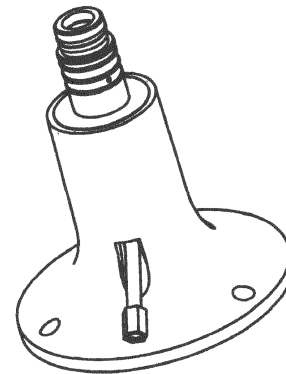
**Button 6055****Pliers 6051****Plate 6056**

**SPECIAL TOOLS (Continued)****Disk 6057****Bolt 6260****Installer 6061****Installer 6261****Remover 6062-A**

**AUTHENTIC  
RESTORATION  
PRODUCT**

**Tip 6268****Holder 6259****Remover/Installer 6301**



**SPECIAL TOOLS (Continued)****Remover/Installer 6302****Puller 7794-A****Installer 6536-A****End Play Socket Set 8266****Cooler Flusher 6906A****AUTHENTIC  
RESTORATION  
PRODUCT****Input Clutch Pressure Fixture 8391**

# TIRES AND WHEELS

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## TIRES

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## DESCRIPTION AND OPERATION

### TIRE

#### DESCRIPTION

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain, in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe application of brakes
- High-speed driving
- Taking turns at excessive speeds
- Striking curbs and other obstacles
- Operating vehicle with over or under inflated tire pressures

Radial ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval shown in the section on Tire Rotation. This will help to achieve a greater tread-life potential.

#### TIRE IDENTIFICATION

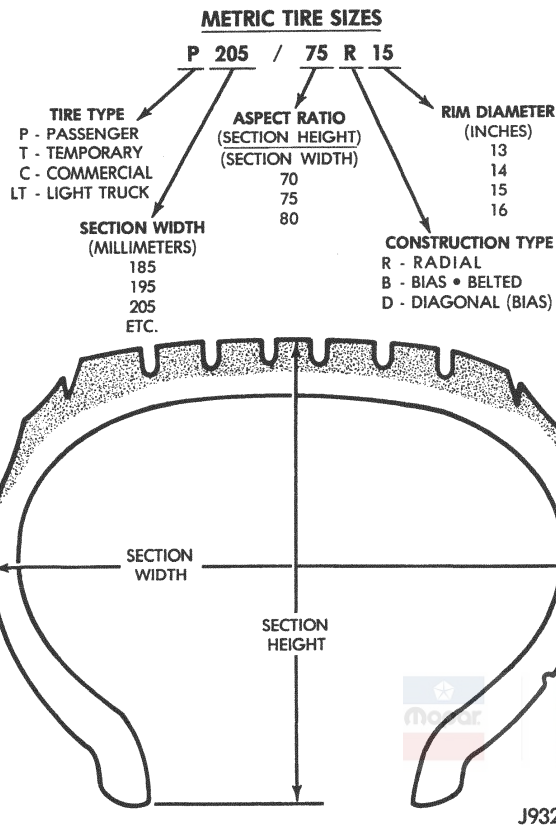
Tire type, size, aspect ratio and speed rating are encoded in the letters and numbers imprinted on the side wall of the tire. Refer to the chart to decipher the tire identification code (Fig. 1).

Performance tires will have a speed rating letter after the aspect ratio number. For example, the letter "S" indicates that the tire is speed rated up to 112 mph (180 km/h). The speed rating is not always printed on the tire sidewall.

- Q -up to 100 mph (160 km/h)
- T -up to 118 mph (190 km/h)
- U -up to 124 mph (200 km/h)
- H -up to 130 mph (210 km/h)
- V -up to 149 mph (240 km/h)
- Z -more than 149 mph (240 km/h) (consult the tire manufacturer for the specific speed rating)

**DESCRIPTION AND OPERATION (Continued)**

An All Season type tire will have either M + S, M & S or M-S (indicating mud and snow traction) imprinted on the side wall.



**Fig. 1 Tire Identification**

**TIRE CHAINS**

Refer to the owners manual supplied with the vehicle to determine whether the use of tire chains is permitted on this vehicle.

**RADIAL-PLY TIRES****DESCRIPTION**

Radial-ply tires improve handling, tread life and ride quality, and decrease rolling resistance.

Radial-ply tires must always be used in sets of four. Under no circumstances should they be used on the front only. They may be mixed with temporary spare tires when necessary. A maximum speed of 50 MPH is recommended while a temporary spare is in use.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They also use the same recommended inflation pressures.

The use of oversized tires, either in the front or rear of the vehicle, can cause vehicle drive train failure. This could also cause inaccurate wheel speed signals when the vehicle is equipped with Anti-Lock Brakes.

The use of tires from different manufactures on the same vehicle is NOT recommended. The proper tire pressure should be maintained on all four tires.

**SPARE TIRE-TEMPORARY****DESCRIPTION**

The temporary spare tire is designed for emergency use only. The original tire should be repaired or replaced at the first opportunity, then reinstalled. Do not exceed speeds of 50 M. P. H. when using the temporary spare tire. Refer to Owner's Manual for complete details.

**REPLACEMENT TIRES****DESCRIPTION**

The original equipment tires provide a proper balance of many characteristics such as:

- Ride
- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

It is recommended that tires equivalent to the original equipment tires be used when replacement is needed.

Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.

The use of oversize tires may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

**WARNING: FAILURE TO EQUIP THE VEHICLE WITH TIRES HAVING ADEQUATE SPEED CAPABILITY CAN RESULT IN SUDDEN TIRE FAILURE.**

**DIAGNOSIS AND TESTING****PRESSURE GAUGES**

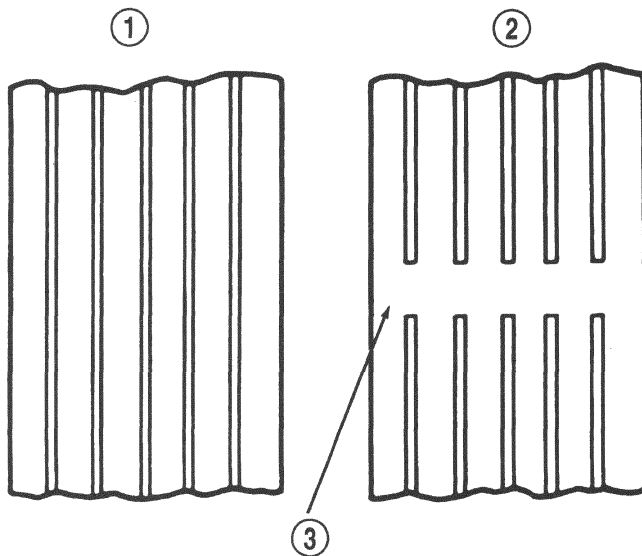
A quality air pressure gauge is recommended to check tire pressure. After checking the air pressure, replace valve cap finger tight.

**TREAD WEAR INDICATORS**

Tread wear indicators are molded into the bottom of the tread grooves. When tread depth is 1.6 mm (1/16 in.), the tread wear indicators will appear as a 13 mm (1/2 in.) band (Fig. 2).

## DIAGNOSIS AND TESTING (Continued)

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.



J8922-5

**Fig. 2 Tread Wear Indicators**

- 1 - TREAD ACCEPTABLE
- 2 - TREAD UNACCEPTABLE
- 3 - WEAR INDICATOR

## TIRE WEAR PATTERNS

Under inflation will cause wear on the shoulders of tire. Over inflation will cause wear at the center of tire.

Excessive camber causes the tire to run at an angle to the road. One side of tread is then worn more than the other (Fig. 3).

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread (Fig. 3).

## TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, vibration, wheel defects, or possibly tire imbalance.

To find out if tires are causing the noise or vibration, drive the vehicle over a smooth road at varying speeds. Note the noise level during acceleration and deceleration. The engine, differential and exhaust noises will change as speed varies, while the tire noise will usually remain constant.

## VEHICLE LEAD DIAGNOSIS AND CORRECTION

Use the following chart to diagnose and correct a vehicle leading or drifting condition.

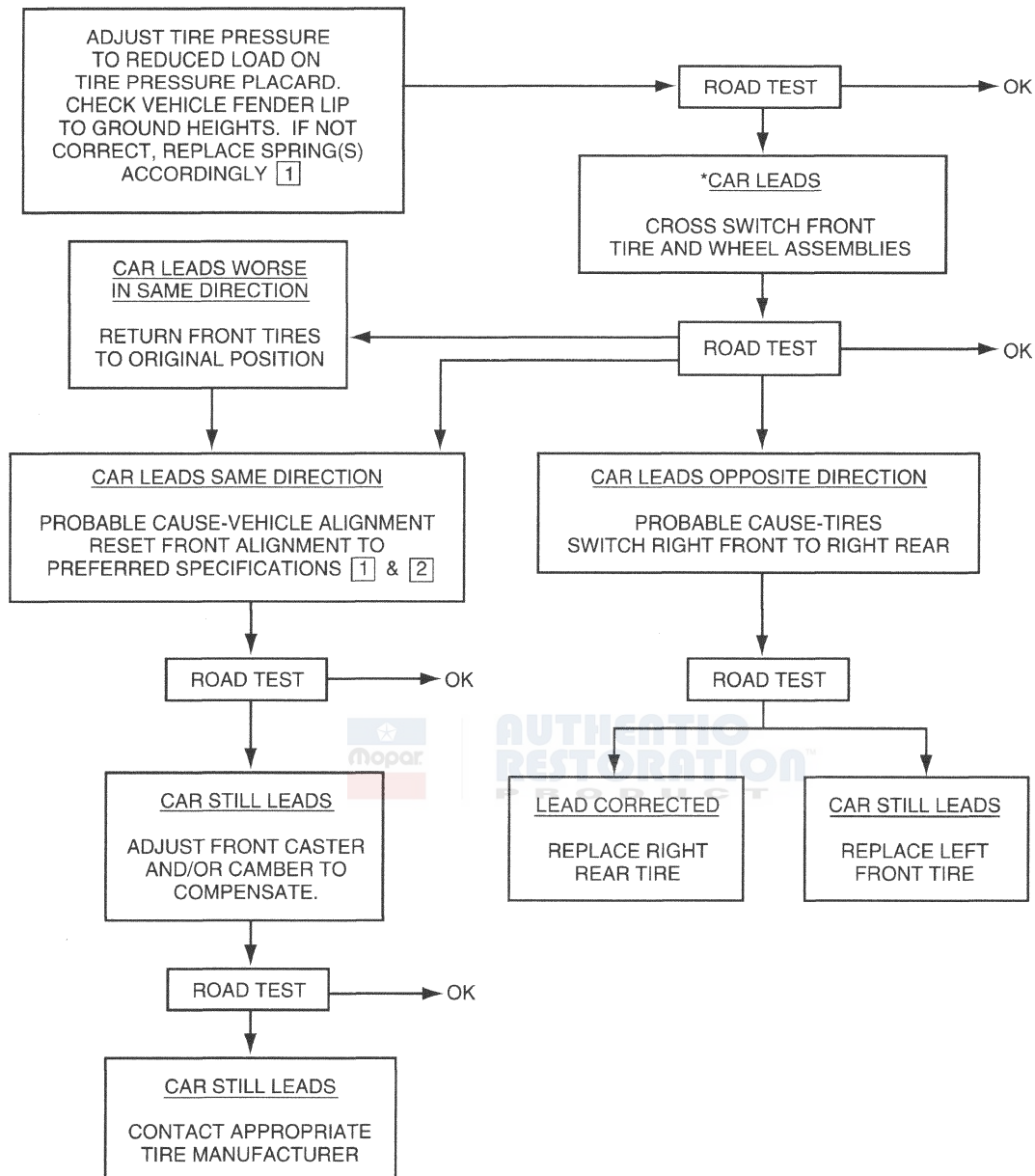
CONDITION	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
EFFECT							
CAUSE	UNDER-INFLATION OR LACK OF ROTATION 	OVER-INFLATION OR LACK OF ROTATION 	UNDER-INFLATION OR EXCESSIVE SPEED*	EXCESSIVE CAMBER 	INCORRECT TOE 	UNBALANCED WHEEL 	LACK OF ROTATION OF TIRES OR WORN OR OUT-OF-ALIGNMENT SUSPENSION.
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES			ADJUST CAMBER TO SPECIFICATIONS	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION SEE GROUP 2

\*HAVE TIRE INSPECTED FOR FURTHER USE.

RN797

**Fig. 3 Tire Wear Patterns**



**DIAGNOSIS AND TESTING (Continued)****VEHICLE LEAD DIAGNOSIS AND CORRECTION CHART**

\*NOTE: VERIFY THAT LEAD IS NOT RELATED TO STEERING WHEEL NOT CENTERED

<sup>[1]</sup> SEE ALIGNMENT SECTION IN GROUP 2 SUSPENSION OF THIS SERVICE MANUAL FOR THE SERVICE AND PREFERRED ALIGNMENT SPECIFICATIONS AND THE VEHICLE FENDER LIP TO GROUND HEIGHTS.

<sup>[2]</sup> REMOVE FRONT SHOCK/SPRING/UPPER CONTROL ARM ASSEMBLY PER INSTRUCTIONS IN FRONT SUSPENSION SECTION. REMOVE BOTH BRACKET TO BODY PLASTIC LOCATOR PINS FROM UPPER SHOCK MOUNT BRACKET. INSTALL SHOCK/SPRING/UPPER CONTROL ARM ASSEMBLY INTO VEHICLE POSITIONING LEFT, RIGHT, OR BOTH UPPER SHOCK MOUNT BRACKETS TO BODY, BY USING THE AVAILABLE CLEARANCE BETWEEN THE BOLT AND SHOCK TOWER HOLES, SUCH THAT:

1) CROSS CAR CASTER MEASUREMENT IS MORE POSITIVE IN THE DIRECTION THE VEHICLE LEADS;

AND/OR,

2) CROSS CAR CAMBER MEASUREMENT IS MORE NEGATIVE IN THE DIRECTION THE VEHICLE LEADS.

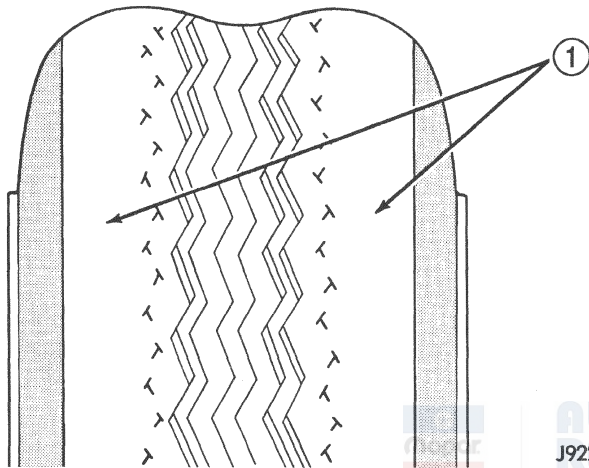
FOR EITHER OF THE ABOVE CONDITIONS, VEHICLE ALIGNMENT MUST BE AT LEAST WITHIN THE SPECIFIED ACCEPTABLE RANGE.

## SERVICE PROCEDURES

### TIRE INFLATION PRESSURES

**WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING. THE TIRE CAN FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.**

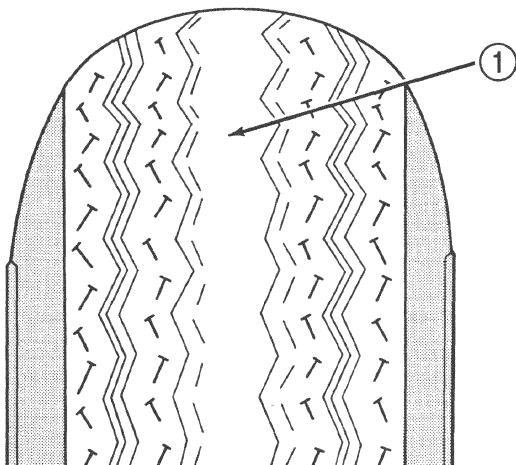
Under inflation causes rapid shoulder wear of the tire tread and tire flexing. This can result in failure of the tire. (Fig. 4).



**Fig. 4 Under Inflation Wear**

1 - THIN TIRE TREAD AREAS

Over inflation causes rapid center wear and loss of the tire's ability to cushion shocks (Fig. 5).



**Fig. 5 Over Inflation Wear**

1 - THIN TIRE TREAD AREA

Improper inflation can cause:

- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- The vehicle to drift.

Proper tire air inflation pressure specifications can be found on the Vehicle Tire Placard provided with the vehicle. See owner's manual.

Tire pressures have been chosen to provide safe operation, vehicle stability, and a smooth ride. Tire pressure should be checked cold once per month. Check tire pressure more frequently when the weather temperature varies widely. Tire pressure will decrease when the outdoor temperature drops.

Tire inflation pressures specified on the placard are always cold inflation pressure. Cold inflation pressure is obtained after the vehicle has not been operated for at least 3 hours, or the vehicle is driven less than one mile after being inoperative for 3 hours. Tire inflation pressures may increase from 2 to 6 pounds per square inch (psi) during operation. Do not reduce this normal pressure build-up.

### TIRE PRESSURE FOR HIGH SPEED OPERATION

#### DESCRIPTION

Where speed limits allow the vehicle to be driven at high speeds, correct tire inflation pressure is very important. For speeds up to and including 120 km/h (75 mph), tires must be inflated to the pressures shown on the tire placard. For continuous speeds in excess of 120 km/h (75 mph), tires must be inflated to the maximum pressure specified on the tire side-wall.

Vehicles loaded to the maximum capacity should not be driven at continuous speeds above 75 mph (120 km/h).

For emergency vehicles that are driven at speeds over 90 mph (144 km/h), special high speed tires must be used. Consult tire manufacturer for correct inflation pressure recommendations.

### TIRE AND WHEEL ROTATION

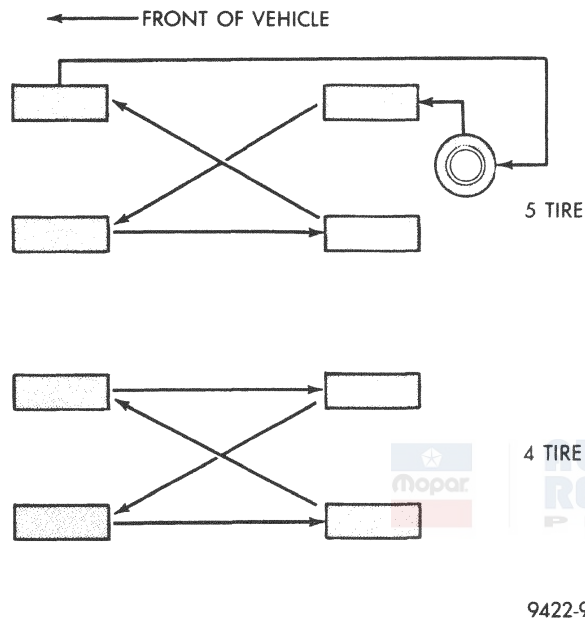
#### NON-DIRECTIONAL TREAD PATTERN TIRES

Tires on the front and rear axles operate at different loads and perform different functions. For these reasons, they wear at unequal rates, and tend to develop irregular wear patterns. These effects can be reduced by timely rotation of tires. The benefits of rotation are especially worthwhile. Rotation will increase tread life, help to maintain mud, snow, and wet traction levels, and contribute to a smooth, quiet ride.

## SERVICE PROCEDURES (Continued)

The suggested rotation method is the forward-cross tire rotation method (Fig. 6). This method takes advantage of current tire industry practice which allows rotation of radial-ply tires. Other rotation methods may be used, but may not have all the benefits of the recommended method.

**NOTE: Only the 4 tire rotation method may be used if the vehicle is equipped with a low mileage or temporary spare tire.**



**Fig. 6 Forward-Cross Tire Rotation Method**

### DIRECTIONAL TREAD PATTERN TIRES

Some vehicles are fitted with special high-performance tires having a directional tread pattern. These tires are designed to improve traction on wet pavement. To obtain the full benefits of this design, the tires must be installed so that they rotate in the correct direction. This is indicated by arrows on the tire sidewalls.

When wheels and tires are being installed, extra care is needed to ensure that this direction of rotation is maintained.

Refer to Owner's Manual for rotation schedule.

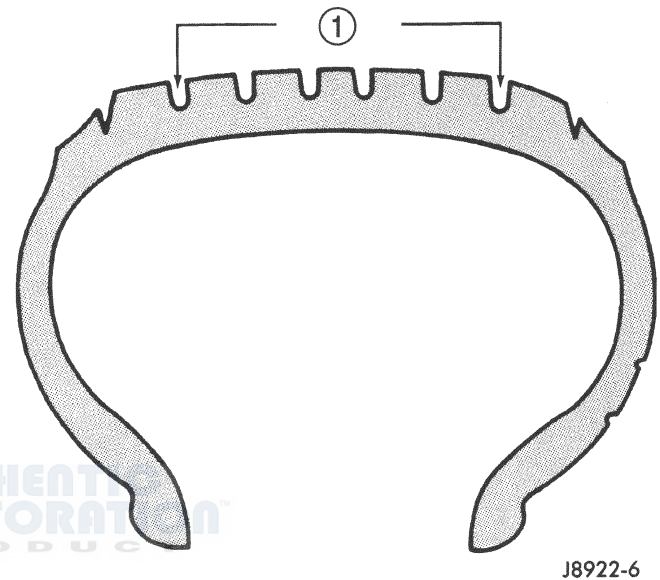
### REPAIRING TIRE LEAKS

For proper repairing, a radial tire must be removed from the wheel. Before dismounting the tire from the wheel, a reference mark should be placed on the tire at the valve stem location. This reference mark will ensure that the tire is remounted back on the wheel in its original position. Repairs should only be made if the defect, or puncture, is in the tread area (Fig. 7). The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before dismounting tire from the wheel. Use lubrication such as a mild soap solution when dismounting or mounting tire. Use tools free of burrs or sharp edges which could damage the tire or wheel rim.

Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

Install wheel on vehicle, and progressively tighten all 5 wheel nuts to a torque of 135 N·m (100 ft. lbs.).



**Fig. 7 Tire Repair Area**

1 - REPAIRABLE AREA

### TIRE AND WHEEL MATCH MOUNTING

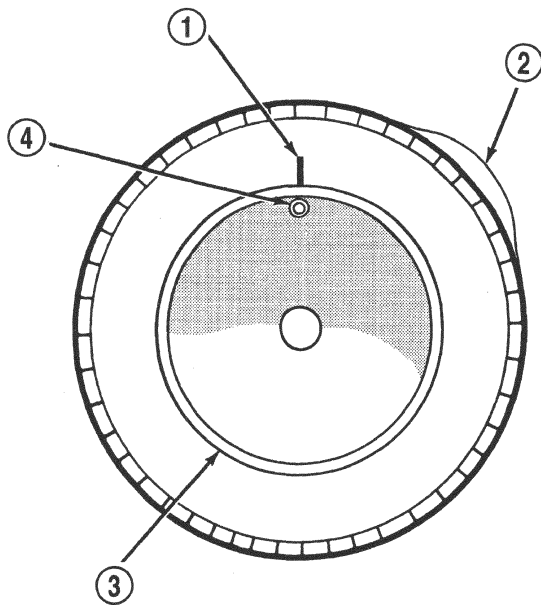
Wheels and tires are match mounted at the factory. This means that the high spot of the tire is matched to the low spot on the wheel rim. This technique is used to reduce run-out in the wheel/tire assembly. The high spot on the tire is marked with a paint mark or a bright colored adhesive label on the outboard sidewall. The low spot on the rim is identified with a label on the outside of the rim and a dot or line in the drop well on the tire side of the rim. If the outside label has been removed the tire will have to be removed to locate the dot or line on the inside of the rim.

Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve stem location. This reference will ensure that it is remounted in the original position on the wheel.

(1) Measure the total indicator runout on the center of the tire tread rib. Record the indicator reading. Mark the tire to indicate the high spot. Place a mark on the tire at the valve stem location (Fig. 8).

(2) Break down the tire and remount it 180 degrees on the rim (Fig. 9).

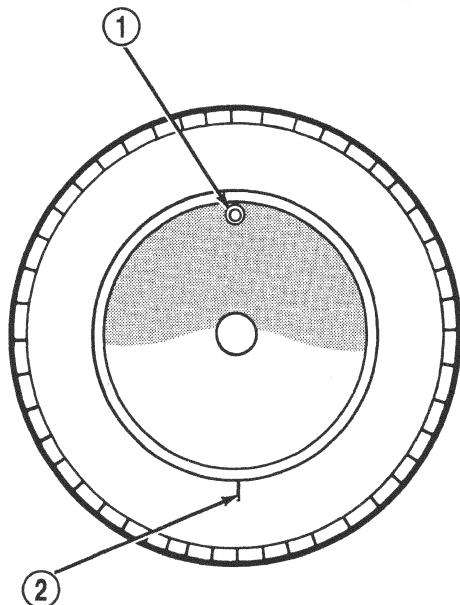


**SERVICE PROCEDURES (Continued)**

J9322-3

**Fig. 8 First Measurement On Tire**

- 1 - REFERENCE MARK
- 2 - 1ST MEASUREMENT HIGH SPOT MARK TIRE AND RIM
- 3 - WHEEL
- 4 - VALVE STEM



J9322-4

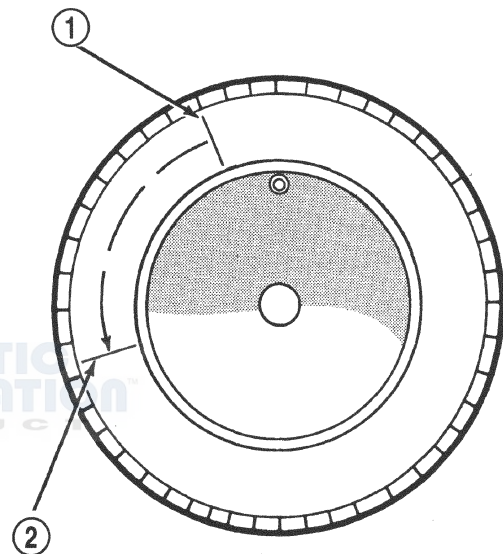
**Fig. 9 Remount Tire 180 Degrees**

- 1 - VALVE STEM
- 2 - REFERENCE MARK

(3) Measure the total indicator runout again. Mark the tire to indicate the high spot.

(4) If runout is still excessive (in excess of 1.524 mm or 0.060 in.), the following procedures must be done.

- If the high spot is within 102 mm (4.0 in.) of the first spot and is still excessive, replace the tire.
- If the high spot is within 102 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications. Refer to Wheel and Tire Runout.
- If the high spot is NOT within 102 mm (4.0 in.) of either high spot, draw an arrow on the tread from second high spot to first. Break down the tire and remount it 90 degrees on rim in that direction (Fig. 10). This procedure will normally reduce the runout to an acceptable amount.



J9322-5

**Fig. 10 Remount Tire 90 Degrees In Direction of Arrow**

- 1 - 2ND HIGH SPOT ON TIRE
- 2 - 1ST HIGH SPOT ON TIRE

**CLEANING AND INSPECTION****CLEANING TIRES**

Remove the protective coating on the tires before delivery of a vehicle. This coating may cause deterioration of the tires.

To remove the protective coating, apply warm water and let it soak for a few minutes. Afterwards, scrub the coating away with a soft bristle brush. Steam cleaning may also be used to remove the coating.

**NOTE: DO NOT use gasoline, mineral oil, oil-based solvent or a wire brush for cleaning.**



## WHEELS

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### DESCRIPTION AND OPERATION

#### WHEEL

##### DESCRIPTION

Original equipment wheels are designed for proper operation at all loads up to the specified maximum vehicle capacity.

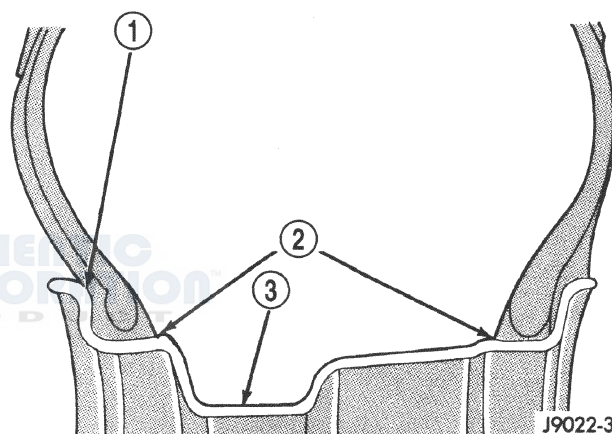
All models use steel or cast aluminum drop center wheels. Every wheel has raised sections between the rim flanges and rim drop well called safety humps (Fig. 1).

Initial inflation of the tires forces the bead over these raised sections. In case of air loss the raised sections help hold the tire in position on the wheel until the vehicle can be brought to a safe stop.

Cast aluminum wheels require special balance weights to fit on the rim flange of the wheel and special wheel clamps for the alignment equipment.

The wheel studs and nuts are designed for specific wheel applications and must be replaced with equivalent parts. Do not use replacement parts of lesser quality or of a substitute design. All aluminum and some steel wheels have wheel stud nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels.

Before installing a wheel, remove any buildup of corrosion on the wheel mounting surface.



**Fig. 1 Safety Rim**

- 1 - FLANGE
- 2 - RIDGE
- 3 - WELL

**WARNING: INSTALLING WHEELS WITHOUT GOOD METAL-TO-METAL CONTACT COULD CAUSE LOOSENING OF WHEEL LUG NUTS. THIS COULD ADVERSELY AFFECT THE SAFETY AND HANDLING OF YOUR VEHICLE.**

## DIAGNOSIS AND TESTING

### WHEEL INSPECTION

Wheels must be replaced if they:

- Have excessive run out
- Are bent, dented or cracked
- Leak air
- Have damaged wheel lug holes

Wheel repairs employing hammering, heating, welding or repairing leaks are not allowed.

Original equipment replacement wheels are available through the dealer. When obtaining replacement wheels from any other source, they must be equivalent in load carrying capacity. The wheel features (diameter, width, offset, brake clearance, and mounting configuration) must match the original equipment wheels.

**WARNING: FAILURE TO USE ORIGINAL EQUIPMENT REPLACEMENT WHEELS MAY ADVERSELY AFFECT THE SAFETY AND HANDLING OF YOUR VEHICLE.**

**WARNING: REPLACEMENT WITH USED WHEELS IS NOT RECOMMENDED. THE SERVICE HISTORY OF THE RIM MAY HAVE INCLUDED SEVERE TREATMENT OR VERY HIGH MILEAGE. THE RIM COULD FAIL WITHOUT WARNING.**

### TIRE AND WHEEL RUNOUT

**NOTE: Runout should always be measured off the vehicle and on a suitable balance machine.**

Radial run out is the difference between the high and low points on the outer edge of the tire or wheel.

Lateral run out is the total side-to-side wobble of the tire or wheel.

Radial run out of more than 1.5 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Lateral run out of more than 2.0 mm (.080 inch) measured at the side of the tire as close to the tread as possible may cause the vehicle to shake.

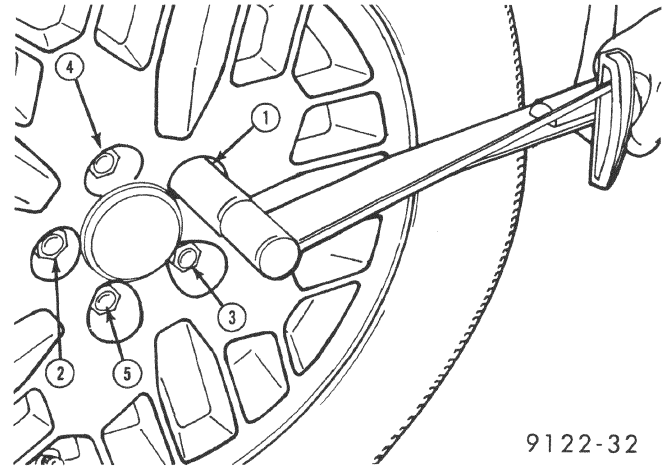
Sometimes radial run out can be reduced by relocating the wheel and tire on the wheel studs (See Method 1). If this does not reduce run out to an acceptable level, the tire can be rotated on the wheel. (See Method 2).

### METHOD 1 (RELOCATE WHEEL ON HUB)

Check accuracy of the wheel mounting surface; adjust wheel bearings.

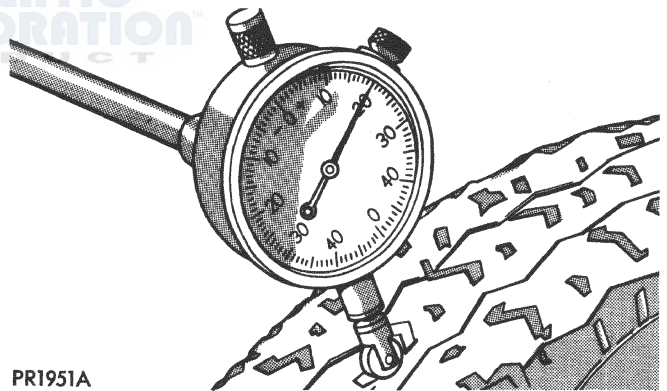
Drive vehicle a short distance to eliminate tire flat spotting from a parked position.

Verify all wheel nuts are properly torqued (Fig. 2).



**Fig. 2 Tightening Wheel Nuts**

Use run out gauge D-128-TR to determine run out (Fig. 3).



**Fig. 3 Run Out Gauge**

Relocate the wheel on the mounting studs, two studs over from the original position.

Retighten wheel nuts until all are properly torqued. This will prevent brake distortion.

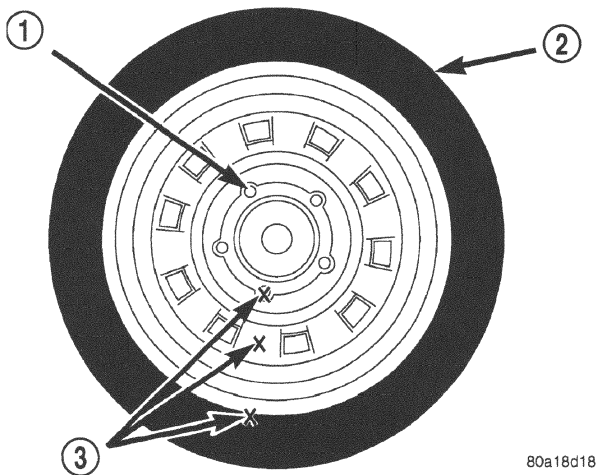
Check radial run out. If still excessive, mark tire sidewall, wheel, and stud at point of maximum run out (Fig. 4) and proceed to Method 2.

### METHOD 2 (RELOCATE TIRE ON WHEEL)

Rotating tire on wheel is particularly effective when there is run out in both tire and wheel.

Remove tire from wheel and remount wheel on hub in former position.

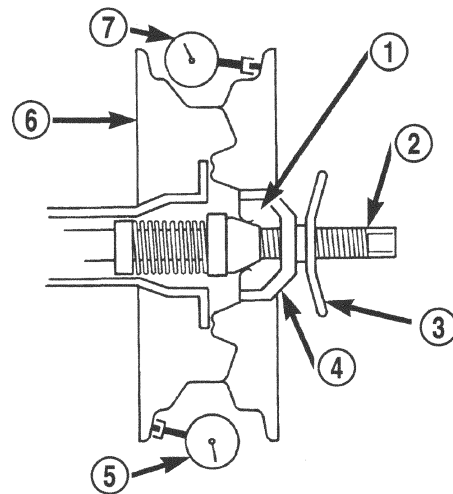
Check wheel radial run out (Fig. 5). It should be no more than 0.762 mm (0.030 inch).

**DIAGNOSIS AND TESTING (Continued)**

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**Fig. 4 Chalk Marking On Wheel, Tire And Stud**

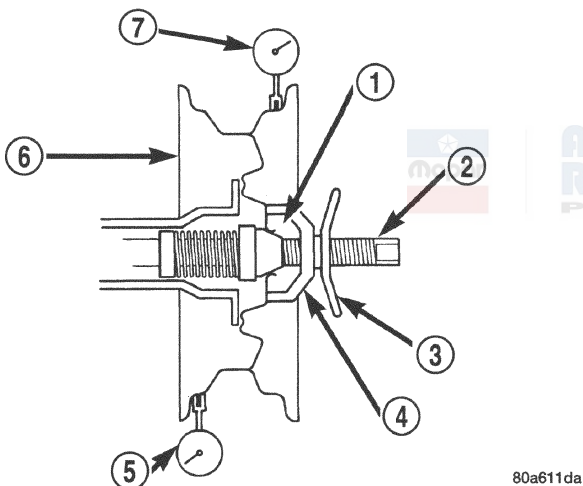
- 1 - STUD
- 2 - TIRE
- 3 - CHALK MARK LOCATIONS



80a611db

**Fig. 6 Checking Wheel Lateral Run Out**

- 1 - MOUNTING CONE
- 2 - SPINDLE SHAFT
- 3 - WING NUT
- 4 - PLASTIC CUP
- 5 - DIAL INDICATOR
- 6 - WHEEL
- 7 - DIAL INDICATOR



80a611da

**Fig. 5 Checking Wheel Radial Run Out**

- 1 - MOUNTING CONE
- 2 - SPINDLE SHAFT
- 3 - WING NUT
- 4 - PLASTIC CUP
- 5 - DIAL INDICATOR
- 6 - WHEEL
- 7 - DIAL INDICATOR

Check wheel lateral run out (Fig. 6). It should be no more than 0.762 mm (0.030 inch).

If the point of greatest wheel radial run out is near the original chalk mark, remount the tire on the rim 180 degrees from its original position. Recheck the run out. If this does not reduce the run out to an acceptable level, replace the wheel and/or the tire.

**SERVICE PROCEDURES****TIRE AND WHEEL BALANCE**

Balancing need is indicated by vibration of seats, floor pan, or steering wheel. The vibration will be noticed mostly when driving over 90 km/h (55 mph) on a smooth road.

It is recommended that a two plane dynamic balancer be used when a wheel and tire assembly require balancing. Static balancing should be used only when a two plane balancer is not available.

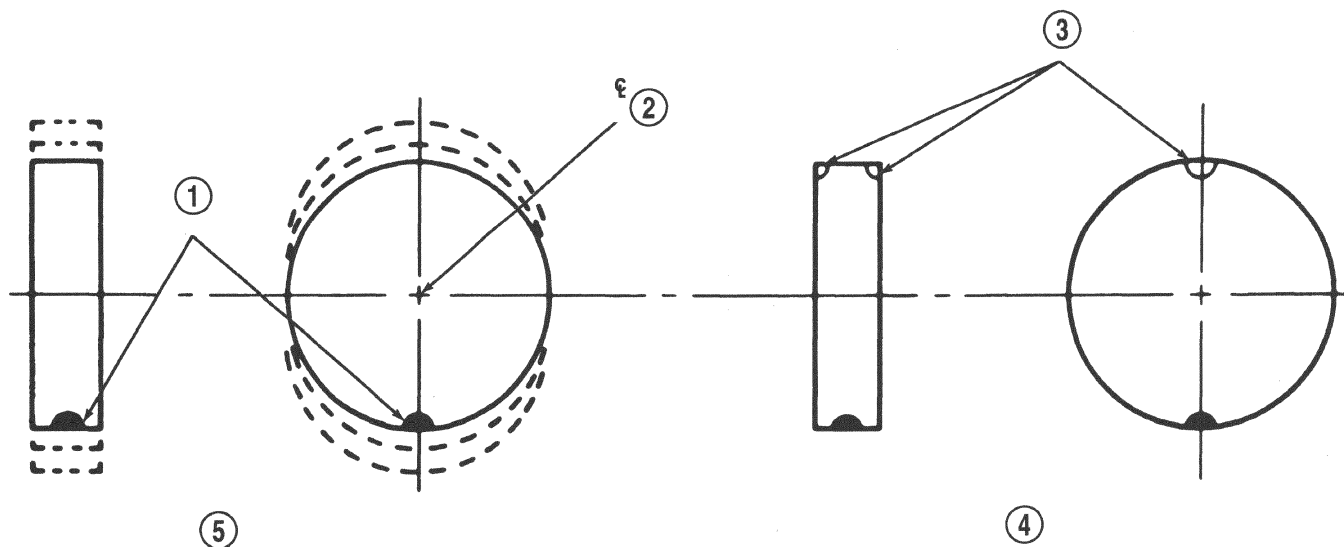
Off-vehicle tire and wheel balancing is recommended to be used on this vehicle.

**NOTE:** If on vehicle equipment is being used to balance the tire /wheel assemblies, remove the opposite tire/wheel from the vehicle.

For static balancing, find the location of heavy spot on tire/wheel causing the imbalance. Counter balance wheel directly opposite the heavy spot. Determine weight required to counterbalance the area of imbalance. Place half of this weight on the **inner** rim flange and the other half on the **outer** rim flange (Fig. 7).

For dynamic balancing, the balancing equipment is designed to indicate the location and amount of weight to be applied to both the inner and outer rim flanges (Fig. 8)

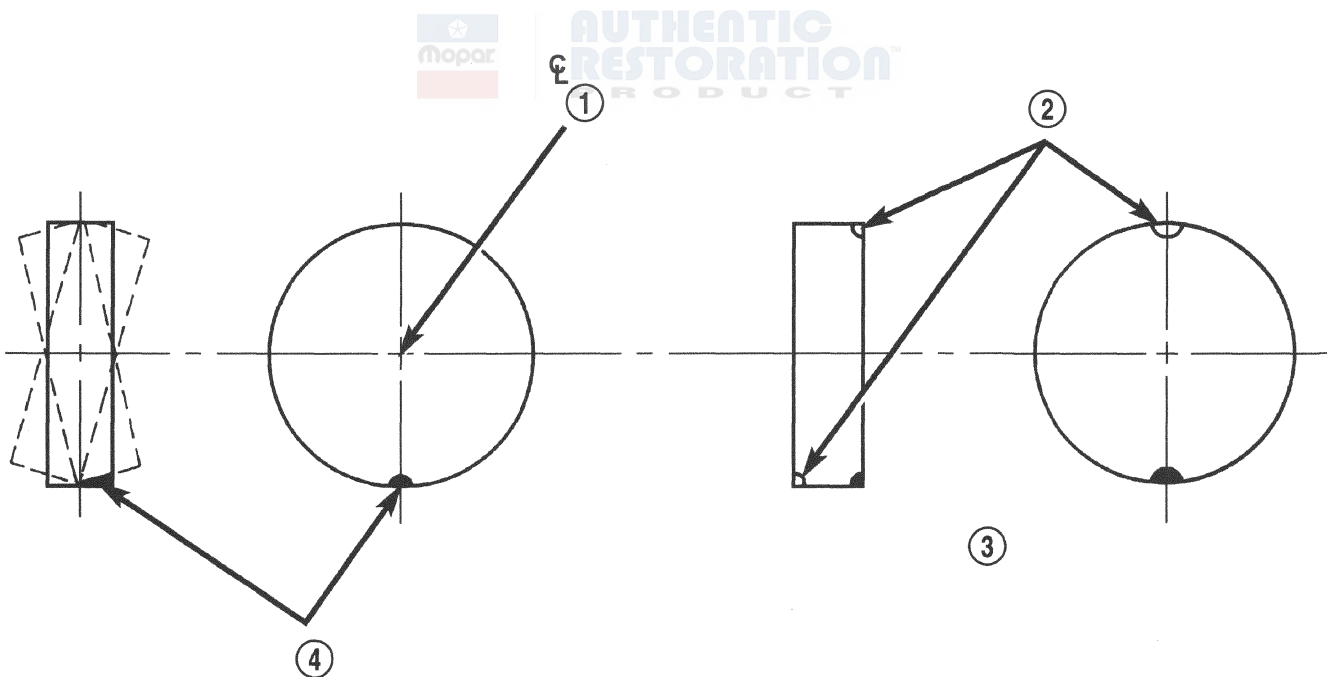
## SERVICE PROCEDURES (Continued)



J8922-8

**Fig. 7 Static Unbalance & Balance**

- |                              |                                       |
|------------------------------|---------------------------------------|
| 1 - HEAVY SPOT               | 4 - CORRECTIVE WEIGHT LOCATION        |
| 2 - OF SPINDLE               | 5 - TIRE OR WHEEL TRAMP, OR WHEEL HOP |
| 3 - ADD BALANCE WEIGHTS HERE |                                       |



80a7ae8e

**Fig. 8 Dynamic Unbalance & Balance**

- |  |   |
|--|---|
| 1 - OF SPINDLE   | 3 - CORRECTIVE WEIGHT LOCATION            |
| 2 - ADD BALANCE WEIGHTS HERE PER DIRECTION OF DYNAMIC BALANCING EQUIPMENT. | 4 - HEAVY SPOT WHEEL SHIMMY AND VIBRATION |



## REMOVAL AND INSTALLATION

### WHEEL AND TIRE

#### REMOVAL

(1) Raise the vehicle so the tires clear ground level. Refer to LUBRICATION AND MAINTENANCE for the required procedure.

(2) If the vehicle is equipped with wheel covers, remove the cover from the wheel by prying it off with an appropriate wheel cover removal tool.

(3) Remove the wheel nuts from the studs.

(4) Remove the tire and wheel from the hub.

#### INSTALLATION

(1) To install the wheel, first position it properly on the studs and hub mounting surface using the hub pilot as a guide. Install and lightly tighten the wheel nuts in the proper sequence (Fig. 9).

**CAUTION:** Never apply oil or grease to the wheel mounting studs or nuts.

(2) Progressively tighten the 5 wheel nuts in the proper sequence (Fig. 9) until tightened to half of the specified torque. Then tighten the wheel nuts in the proper sequence to a torque of 135 N·m (100 ft. lbs.).

(3) If equipped with wheel covers, align the valve stem notch in the wheel cover with the valve stem on the wheel. By hand, tap the wheel cover onto the wheel until it is fully seated against the wheel.

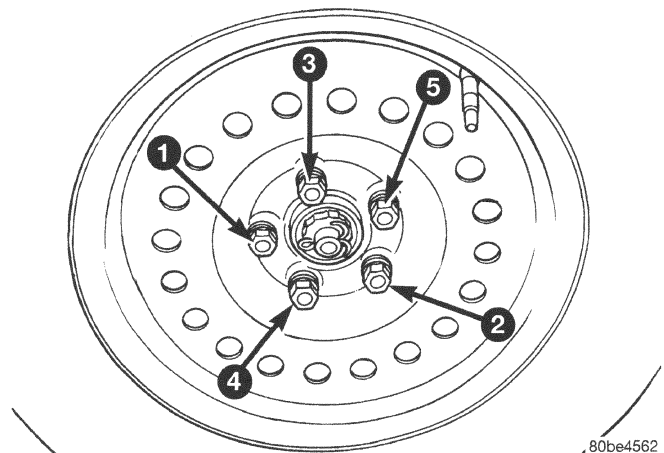
(4) Lower the vehicle.

### CLEANING AND INSPECTION

#### ALUMINUM WHEEL CARE

Chrome plated and painted aluminum wheels should be cleaned regularly using mild soap and water to maintain their luster and to prevent corrosion.

Care must be taken in the selection of tire and wheel cleaning chemicals and equipment to prevent



**Fig. 9 Wheel Nut Tightening Sequence**

damage to the wheels. Any of the "DO NOT USE" items listed below WILL damage chrome plated and painted aluminum wheels.

#### DO NOT USE:

- any abrasive metal cleaner
- any abrasive cleaning pad or brush
- any cleaner that contains an acid (this will immediately react with and discolor the chromium surface)
- chrome polish (unless it is buffed off immediately after application)
- oven cleaner
- a car wash that uses carbide-tipped wheel cleaning brushes

### SPECIFICATIONS

#### WHEEL SPECIFICATIONS

##### Wheel:

Mounting Stud Size . . . . .	M12 x 1.5mm
Mounting Stud Lug Nut Hex Size . . . . .	19mm
Mounting Lug Nut Tightening Torque . .	135 N·m (100 ft. lbs.)

## BODY

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## PAINT

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		AFTERMARKET PAINT REPAIR PRODUCTS .....	2

### DESCRIPTION AND OPERATION

#### PAINT CODE

##### DESCRIPTION

Exterior vehicle body colors are identified on the Body Code plate. The plate is located on the in the engine compartment and attached to the top of the right frame rail. Refer to the Introduction section at the front of this manual for body code plate description. The paint code is also identified on the Vehicle Safety Certification Label which is located on the drivers door shut face. The first digit of the paint code listed on the vehicle indicates the sequence of application, i.e.: P = primary coat, Q = secondary coat. The codes listed in the Aftermarket Paint Repair Products chart are used for manufacturing purposes. The first digit may vary from the Body Code Plate. The color names provided in the Aftermarket Paint Repair Products chart are the color names used on most repair product containers.

#### BASE COAT/CLEAR COAT FINISH

##### DESCRIPTION

On most vehicles a two-part paint application (base coat/clear coat) is used. Color paint that is applied to primer is called base coat. The clear coat protects the

base coat from ultraviolet light and provides a durable high-gloss finish.

**CAUTION:** Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.

Do not use harsh alkaline based cleaning solvents on painted surfaces. Damage to finish or color can result.

#### FINESSE SANDING, BUFFING, AND POLISHING

##### DESCRIPTION

Minor acid etching, orange peel, or smudging in clear coat or single-stage finishes can be reduced with light finesse sanding, hand buffing, and polishing. **If the finish has been finesse sanded in the past, it cannot be repeated. Finesse sanding operation should be performed by a trained automotive paint technician.**

**CAUTION:** Do not remove clear coat finish, if equipped. Base coat paint must retain clear coat for durability.

**DESCRIPTION AND OPERATION (Continued)****PAINTED SURFACE TOUCH-UP****DESCRIPTION**

When a painted metal surface has been scratched or chipped, it should be touched-up as soon as possible to avoid corrosion. For best results, use Mopar® Scratch Filler/Primer, Touch-Up Paints and Clear Top Coat. Refer to Introduction group of this manual for Body Code Plate information.

**WARNING: USE A OSHA APPROVED BREATHING FILTER WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.**

**TOUCH-UP PROCEDURE**

- (1) Scrape loose paint and corrosion from inside scratch or chip.
- (2) Clean affected area with Mopar® Tar/Road Oil Remover, and allow to dry.
- (3) Fill the inside of the scratch or chip with a coat of filler/primer. Do not overlap primer onto good surface finish. The applicator brush should be wet

enough to puddle-fill the defect without running. Do not stroke brush applicator on body surface. Allow the filler/primer to dry hard.

(4) Cover the filler/primer with color touch-up paint. Do not overlap touch-up color onto the original color coat around the scratch or chip. Butt the new color to the original color, if possible. Do not stroke applicator brush on body surface. Allow touch-up paint to dry hard.

(5) On vehicles without clear coat, the touch-up color can be lightly finesse sanded (1500 grit) and polished with rubbing compound.

(6) On vehicles with clear coat, apply clear top coat to touch-up paint with the same technique as described in Step 4. Allow clear top coat to dry hard. If desired, Step 5 can be performed on clear top coat.

**WARNING: AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.**  
**AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.**

**AFTERMARKET PAINT REPAIR PRODUCTS**

**Authentic Mopar Exterior Colors**

EXTERIOR COLOR	DAIMLER CHRYSLER CODE	PPG	DuPONT	S-W M-S **	AKZO/ NOBEL SIKKENS	SPIES HECKER	ICI **
Black Clear Coat	DX8	9700	F0204	34858	CHA85:DX8	73328	TC60B
Bright Silver Metallic Clear Coat	WS2	5464	F7999	56150	CHA99:WS2	74611	KDP8B
Bright White Clear Coat	GW7	4037	B8833	37298	CHA88:GW7	11751	TA45B
Champagne Pearl Metallic Pearl Coat	VTE	5360	B9825	55700	CHA98:VTE	33686	JAF2B
Deep Cranberry Pearl Coat	VMT	5359	B9842	54119	CHA98:VMT	33686	GJX2B
Inferno Red Tinted Pearl Coat	WEL	5469 5470	B9843	56090	CHA99:WEL	34461	KDR5B
Light Cypress Green Pearl Coat	WG2	5471	B9843	56090	CHA99:WG2	65521	KDH3B
Shale Green Metallic Clear Coat	XGR	5577	F9240	57765	CHA00:XGR	66088	PVJ8B
Taupe Frost Pearl Coat	TTK	5244	B9750	52567	CHA97:TTK	80595	FNE5B

\*BASF, Glasurit, Herberts and Standox use the DaimlerChrysler paint code.

\*\*S-W = Sherwin-Williams, M-S = Martin Senour, ICI = Autocolor



**DESCRIPTION AND OPERATION (Continued)****LOWER BODY APPLIQUE COLORS**

LOWER BODY APPLIQUE COLORS	DAIMLER CHRYSLER CODE	PPG	DuPONT	S-W M-S **	AKZO/NOBEL SIKKENS	SPIES HECKER	ICI **
Black Clear Coat	DX8	9700	F0204	34858	CHA85:DX8	73328	TC60B
Bright Silver Metallic Clear Coat	WS2	5464	F7999	56150	CHA99:WS2	74611	KDP8B
Bright White Clear Coat	GW7	4037	B8833	37298	CHA88:GW7	11751	TA45B
Champagne Pearl Metallic Pearl Coat	VTE	5360	B9825	55700	CHA98:VTE	33686	JAF2B
Deep Cranberry Pearl Coat	VMT	5359	B9842	54119	CHA98:VMT	33686	GJX2B
Inferno Red Tinted Pearl Coat	WEL	5469 5470	B9843	56090	CHA99:WEL	34461	KDR5B
Light Cypress Green Pearl Coat	WG2	5471	B9843	56090	CHA99:WG2	65521	KDH3B
Shale Green Metallic Clear Coat	XGR	5577	F9240	57765	CHA00:XGR	66088	PVJ8B
Taupe Frost Pearl Coat	TTK	5244	B9750	52567	CHA97:TTK	80595	FNE5B

**INTERIOR COLORS**

INTERIOR COLORS	DAIMLER CHRYSLER CODE	PPG	DuPONT	S-W M-S **	AKZO/NOBEL SIKKENS	SPIES HECKER	ICI **
Agate Light Camel	AK	9856 2-1586	C9208 B8696	45994 60115	CHALAZI CHARK4I	75016	7WC8 7WC5
Agate	AZ	9856 2-1461	C9208	45994	CHALAZI	75016	7WC8
Camel	K5	27731 2-1584	C9603	51541	CHARK5I	81796	7VX6
Silver Fern	JK	35798 2-1577	C9516	50510	CHARJKI	75061	7WB4



## STATIONARY GLASS

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### DESCRIPTION AND OPERATION

#### SAFETY PRECAUTIONS

##### DESCRIPTION

**WARNING: DO NOT OPERATE THE VEHICLE WITHIN 24 HOURS OF WINDSHIELD INSTALLATION. IT TAKES AT LEAST 24 HOURS FOR URETHANE ADHESIVE TO CURE. IF IT IS NOT CURED, THE WINDSHIELD MAY NOT PERFORM PROPERLY IN AN ACCIDENT.**

URETHANE ADHESIVES ARE APPLIED AS A SYSTEM. USE GLASS CLEANER, GLASS PREP SOLVENT, GLASS PRIMER, PVC (VINYL) PRIMER AND PINCH WELD (FENCE) PRIMER PROVIDED BY THE ADHESIVE MANUFACTURER. IF NOT, STRUCTURAL INTEGRITY COULD BE COMPROMISED.

DAIMLERCHRYSLER DOES NOT RECOMMEND GLASS ADHESIVE BY BRAND. TECHNICIANS SHOULD REVIEW PRODUCT LABELS AND TECHNICAL DATA SHEETS, AND USE ONLY ADHESIVES THAT THEIR MANUFACTURES WARRANT WILL RESTORE A VEHICLE TO THE REQUIREMENTS OF FMVSS 212. TECHNICIANS SHOULD ALSO INSURE THAT PRIMERS AND CLEANERS ARE COMPATIBLE WITH THE PARTICULAR ADHESIVE USED.

BE SURE TO REFER TO THE URETHANE MANUFACTURER'S DIRECTIONS FOR CURING TIME SPECIFICATIONS, AND DO NOT USE ADHESIVE AFTER ITS EXPIRATION DATE.

VAPORS THAT ARE EMITTED FROM THE URETHANE ADHESIVE OR PRIMER COULD CAUSE PERSONAL INJURY. USE THEM IN A WELL-VENTILATED AREA.

SKIN CONTACT WITH URETHANE ADHESIVE SHOULD BE AVOIDED. PERSONAL INJURY MAY RESULT.

ALWAYS WEAR EYE AND HAND PROTECTION WHEN WORKING WITH GLASS.

**CAUTION: Protect all painted and trimmed surfaces from coming in contact with urethane or primers.**

**Be careful not to damage painted surfaces when removing moldings or cutting urethane around windshield.**

It is difficult to salvage a windshield during the removal operation. The windshield is part of the structural support for the roof. The urethane bonding used to secure the windshield to the fence is difficult to cut or clean from any surface. If the moldings are set in urethane, it would also be unlikely they could be salvaged. Before removing the windshield, check the availability of the windshield and moldings from the parts supplier.

### REMOVAL AND INSTALLATION

#### WINDSHIELD

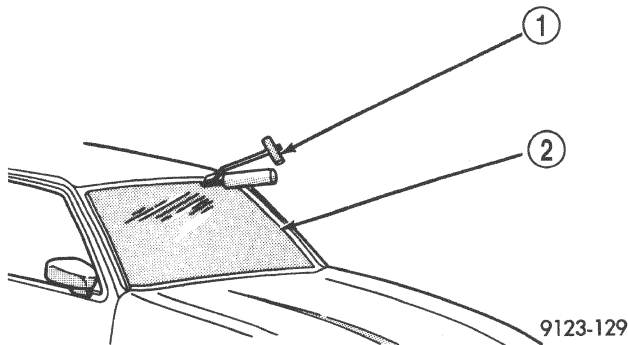
The urethane adhesive holding the windshield to the opening pinch weld (fence) can be cut using a sharp cold knife from the exterior of the vehicle. Using the cold knife method is effective if the windshield is already broken. If the glass must be salvaged, cutting the urethane adhesive from the interior of the vehicle using a reciprocating or oscillating power knife is recommended.

#### WINDSHIELD REMOVAL – EXTERIOR METHOD

- (1) Open convertible top.
- (2) Remove header/A-pillar weatherstrip from weatherstrip retainers.
- (3) Remove A-pillar weatherstrip retainer and molding.
- (4) Remove header weatherstrip/molding.
- (5) Mark top edge of the windshield glass at three locations on the header.
- (6) Remove windshield wiper arms.
- (7) Remove cowl cover.
- (8) Place protective covers over instrument panel and hood.
- (9) Using a sharp cold knife, cut urethane adhesive holding the windshield to the A-pillars, header and cowl pinch weld fences (Fig. 1). A power cutting device can be used if available.

## REMOVAL AND INSTALLATION (Continued)

- (10) Remove windshield from vehicle.



**Fig. 1 Cut Urethane Around Windshield**

- 1 - COLD KNIFE  
2 - WINDSHIELD

### WINDSHIELD REMOVAL - INTERIOR METHOD

- (1) Remove cowl cover.
- (2) Open convertible top.
- (3) Remove header/A-pillar weatherstrip from weatherstrip retainers.
- (4) Remove A-pillar weatherstrip retainer and molding.
- (5) Remove header weatherstrip/molding.
- (6) Mark top edge of the windshield glass at three locations on the header.
- (7) Remove header panel trim cover.
- (8) Remove header panel weatherstrip from channel.
- (9) Remove instrument panel top cover. Refer to Group 8E, Instrument Panel.
- (10) Remove A-pillar trim covers.
- (11) Place protective covers over instrument panel and hood.
- (12) Using a reciprocating or oscillating power knife, cut urethane adhesive holding the windshield to the A-pillars, roof header and cowl pinch weld fences. Refer to instructions provided with the equipment being used.
- (13) Remove windshield from vehicle.

### WINDSHIELD INSTALLATION

**CAUTION:** Open the left front door glass before installing windshield to avoid pressurizing the passenger compartment. If a door is slammed before urethane bonding is cured, water leaks can result.

Allow the urethane at least 24 hours to cure before returning the vehicle to use.

To avoid stressing the replacement windshield, the urethane bonding material on the windshield fence should be smooth and consistent to the shape of the replacement windshield. The support spacers should be cleaned and properly installed on weld studs or repair screws at bottom of windshield opening.

**NOTE:** The JX uses adjustable support spacers along the bottom. Once the support spacers are set, use care not to move them.

(1) Place replacement windshield into windshield opening and position glass in the center of the opening against the support spacers.

(2) Verify the glass lays evenly against the pinch weld fence at the sides, top and bottom of the replacement windshield. If not, the pinch weld fence must be formed to the shape of the new glass.

(3) Move the support spacers as necessary so that the top of the windshield aligns with the marks on the header, from the original windshield.

(4) Place a piece of tape over the ratcheting portion of the bottom support spacer to prevent them from moving.

(5) Repeat Step 3 and Step 4 for the opposite side of the windshield.

(6) Mark the glass at the support spacers with a grease pencil or pieces of masking tape and ink pen to use as a reference for installation (Fig. 2).

(7) Remove replacement windshield from windshield opening.

(8) Position the windshield inside up on a suitable work surface with two padded, wood 10 cm by 10 cm by 50 cm (4 in. by 4 in. by 20 in.) blocks, placed parallel 75 cm (2.5 ft.) apart (Fig. 3).

**WARNING: DO NOT USE SOLVENT BASED GLASS CLEANER TO CLEAN WINDSHIELD BEFORE APPLYING GLASS PREP AND PRIMER. POOR ADHESION CAN RESULT.**

(9) Clean inside of windshield with ammonia based glass cleaner and lint-free cloth.

(10) Apply Glass Prep adhesion promoter 25 mm (1 in.) wide around perimeter of windshield and wipe with clean/dry lint-free cloth until no streaks are visible.

(11) Apply Glass Primer 25 mm (1 in.) wide around perimeter of windshield. Allow at least three minutes drying time.

(12) Using a razor knife, remove as much original urethane as possible. Do not damage paint on windshield fence.

(13) Apply pinch weld primer 15 mm (.75 in.) wide around the windshield fence. Allow at least three minutes drying time.

(14) If a low viscosity urethane adhesive is used, install compression spacers on the fence around the windshield opening at original locations (Fig. 4).

(15) Apply a 10 mm (0.4 in.) bead of urethane on center line of windshield fence.

(16) With the aid of a helper, position the windshield over the windshield opening. Align the reference marks at the bottom of the windshield to the support spacers.

## REMOVAL AND INSTALLATION (Continued)

(17) Slowly lower windshield glass to windshield opening fence. Push windshield inward until glass is flush to A-pillars (Fig. 5).

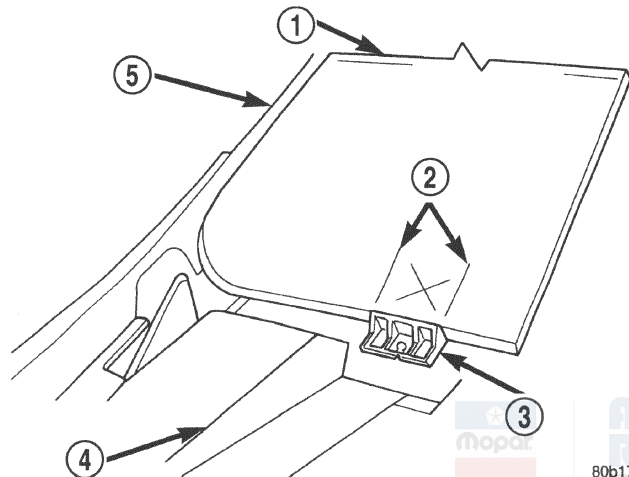
(18) Clean access urethane from exterior with Mopar® Super Kleen or equivalent.

(19) Apply 150 mm (6 in.) lengths of 50 mm (2 in.) masking tape spaced 250 mm (10 in.) apart to hold molding in place until urethane cures.

(20) Install cowl cover and wipers.

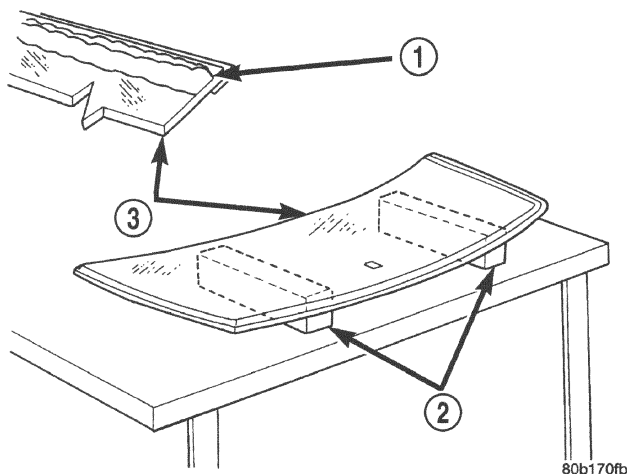
(21) Install inside rear view mirror to header.

(22) After urethane has cured, remove tape strips and water test windshield to verify repair.



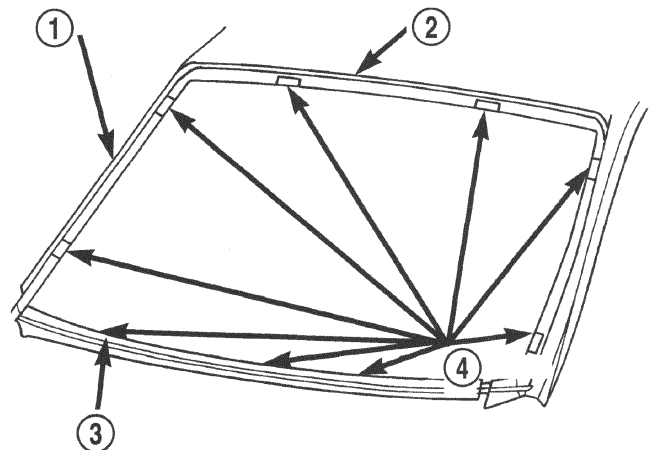
**Fig. 2 Center Windshield and Mark at Support Spacers**

- 1 - WINDSHIELD
- 2 - MARKS
- 3 - ADJUSTABLE SUPPORT SPACER
- 4 - COWL
- 5 - A-PILLAR



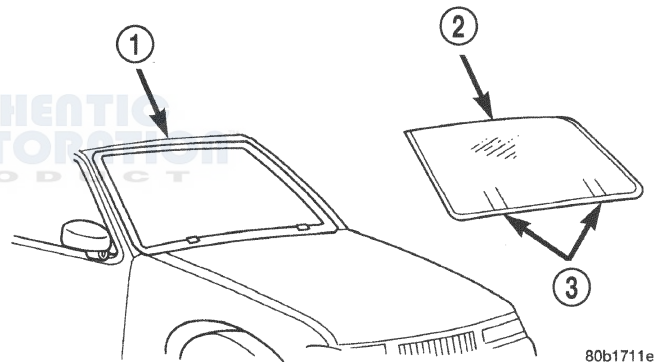
**Fig. 3 Work Surface Set Up**

- 1 - URETHANE BEAD AROUND GLASS 7mm (.3 in.) FROM EDGE
- 2 - BLOCKS
- 3 - WINDSHIELD



**Fig. 4 Position Urethane Compression Spacers - Typical**

- 1 - A-PILLAR
- 2 - ROOF PANEL
- 3 - WINDSHIELD OPENING
- 4 - SPACERS



**Fig. 5 Lower Windshield Into Position**

- 1 - FENCE
- 2 - WINDSHIELD WITH URETHANE APPLIED
- 3 - REFERENCE MARKS

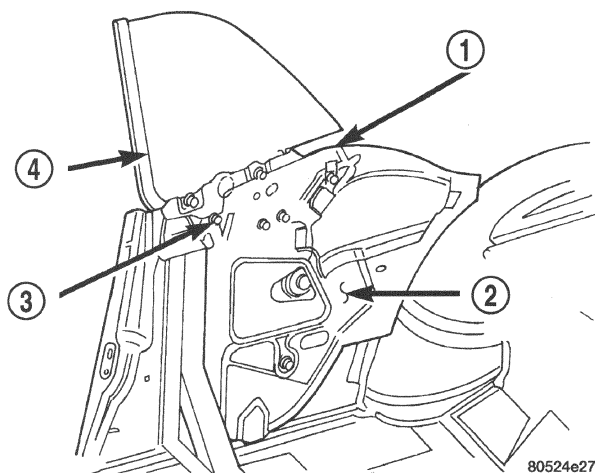
## QUARTER GLASS

**NOTE:** No access is provided to glass fasteners except if glass is in the full up position. If this position can not be achieved, remove the quarter window module. Refer to quarter window module procedure in this section.

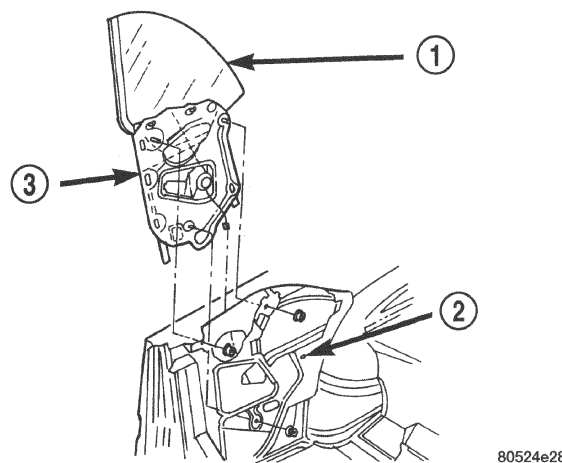
## REMOVAL

- (1) Raise glass to full up position.
- (2) Remove quarter trim panel.
- (3) Partially lower convertible top.
- (4) Remove fasteners attaching glass to lift channel of quarter window module (Fig. 6).
- (5) Loosen latch plate hook nut.
- (6) Separate glass from vehicle.



**REMOVAL AND INSTALLATION (Continued)****Fig. 6 Quarter Glass**

- 1 - QUARTER GLASS LIFT CHANNEL
- 2 - INNER QUARTER PANEL
- 3 - LATCH PLATE HOOK NUT
- 4 - QUARTER GLASS

**Fig. 7 Quarter Window Module**

- 1 - QUARTER GLASS
- 2 - INNER QUARTER PANEL
- 3 - QUARTER WINDOW MODULE

**INSTALLATION**

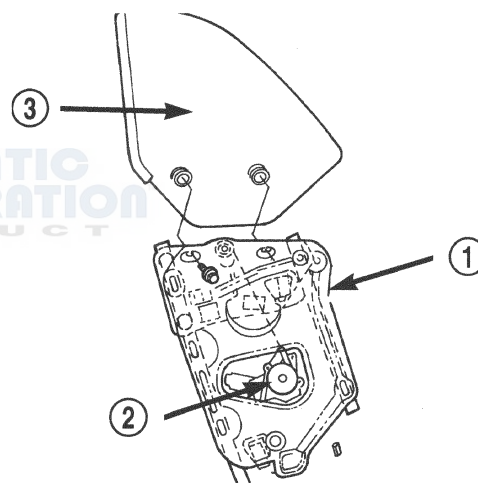
- (1) Position glass in vehicle.
- (2) Loosely install fasteners holding glass to lift channel of quarter window module.
- (3) Lower and secure convertible top.
- (4) Tighten latch plate hook nut.
- (5) Adjust quarter glass as necessary. Refer to quarter glass adjustment procedure in this section.
- (6) Install quarter trim panel.

**QUARTER WINDOW MODULE****REMOVAL**

- (1) Raise quarter glass to full up position, if possible, to aid in removal.
- (2) Remove quarter trim panel.
- (3) Partially lower convertible top.
- (4) Disconnect wire connector to power window motor.
- (5) Remove fasteners holding quarter window module to inner quarter panel (Fig. 7).
- (6) Lift quarter window module upward and out opening at top of quarter panel.
- (7) Separate quarter glass from quarter window module (Fig. 8).

**INSTALLATION**

- (1) Lower quarter window module into position through opening in top of quarter panel.
- (2) Install fasteners holding quarter window module to inner quarter panel.

**Fig. 8 Quarter Glass**

- 1 - QUARTER WINDOW MODULE
- 2 - POWER QUARTER WINDOW MOTOR
- 3 - QUARTER GLASS

- (3) Connect wire connector to power window motor.
- (4) Raise glass lift channel to full up position.
- (5) Position quarter glass on quarter window module.
- (6) Loosely install fasteners holding quarter glass to quarter window module.
- (7) Lower and secure convertible top.
- (8) Adjust quarter glass as necessary. Refer to quarter glass adjustment procedure in this section.
- (9) Install quarter trim panel.



## ADJUSTMENTS

### QUARTER GLASS ADJUSTMENT

**NOTE:** The door glass must be properly adjusted prior to performing any quarter glass adjustments.

#### UP-STOP ADJUSTMENTS

- (1) Remove quarter trim panel.
- (2) Remove center and rear side rail weatherstrips from side rail weatherstrip retainer channels.
- (3) Loosen up-stop nuts.
- (4) Raise quarter glass.
- (5) Slide up-stop to achieve proper glass to weatherstrip retainer gap. Refer to the Quarter Glass Adjustment Specifications Table.
- (6) Tighten all fasteners.
- (7) Install center and rear side rail weatherstrips to side rail weatherstrip retainer channels.
- (8) Cycle quarter glass between full up and full down positions. Verify operation and adjust as necessary.
- (9) Verify that the top edge of the door glass is beneath the lip of the weatherstrip.
- (10) Install quarter trim panel.

#### TOP OF GLASS – INBOARD/OUTBOARD ADJUSTMENTS

- (1) Remove quarter trim panel.
- (2) Remove center and rear side rail weatherstrips from side rail weatherstrip retainer channels.
- (3) Using a suitable wrench, loosen the lower jack screw jam-nuts.
- (4) Raise quarter glass.
- (5) Using a suitable allen wrench, rotate jack-screws to achieve the proper gap between the door glass weatherstrip retainer channel. Refer to the Quarter Glass Adjustment Specifications Table.
- (6) Verify that the quarter glass maintains even contact with the outer belt weatherstrip.
- (7) Install center and rear side rail weatherstrips to side rail weatherstrip retainer channels.

(8) Cycle quarter glass between full up and full down positions. Verify operation and adjust as necessary.

(9) Tighten all fasteners.

(10) Verify that the top edge of the door glass is beneath the lip of the weatherstrip with glass in the full up position.

(11) Install quarter trim panel.

#### GLASS – FRONT/REAR ADJUSTMENT

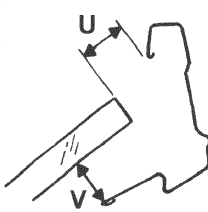
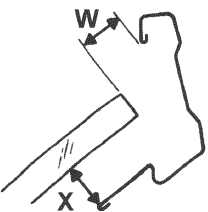
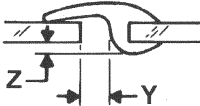
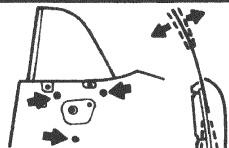
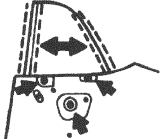
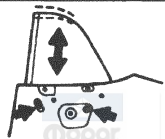
- (1) Remove quarter trim panel.
- (2) Remove center and rear side rail weatherstrips from side rail weatherstrip retainer channels.
- (3) Loosen glass attachment bolts.
- (4) Raise quarter glass and position correctly. Refer to the Quarter Glass Adjustment Specifications Table.
- (5) Tighten all fasteners.
- (6) Install center and rear side rail weatherstrips to side rail weatherstrip retainer channels.
- (7) Cycle quarter glass between full up and full down positions. Verify operation and adjust as necessary.
- (8) Install quarter trim panel.

#### QUARTER GLASS ALIGNMENT VERIFICATION

- (1) Raise door glass to full up position.
- (2) Cycle quarter glass between full up and full down positions.
- (3) Verify that quarter glass operates smoothly and maintains correct alignment to convertible top and door glass.
- (4) Verify that quarter glass weatherstrip fully contacts door glass.
- (5) Verify that no scissoring of the door glass and weatherstrip occurs.
- (6) If any of the above conditions are found,
  - (a) Adjust quarter glass.
  - (b) Adjust the door glass as necessary to cure the condition.

**ADJUSTMENTS (Continued)**

**QUARTER GLASS ADJUSTMENT SPECIFICATIONS**

			MEASUREMENT LOCATIONS AND THEIR VALUES					
			SECTION A-A		SECTION B-B		SECTION C-C	
								
SEQUENCE		ADJUSTMENT	U	V	W	X	Y	Z
1	IN/OUT			20.0mm ±2mm		20.0mm ±2mm		2.0mm ±1mm
2	FORWARD/ REARWARD		10.0mm ±2mm		10.0mm ±3mm		6.0mm ±1mm	
	UP/DOWN		10.0mm ±2mm		10.0mm ±3mm			

**NOTE:** Forward / Rearward and Up/Down adjustment are to be made at the same time.

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SEATS

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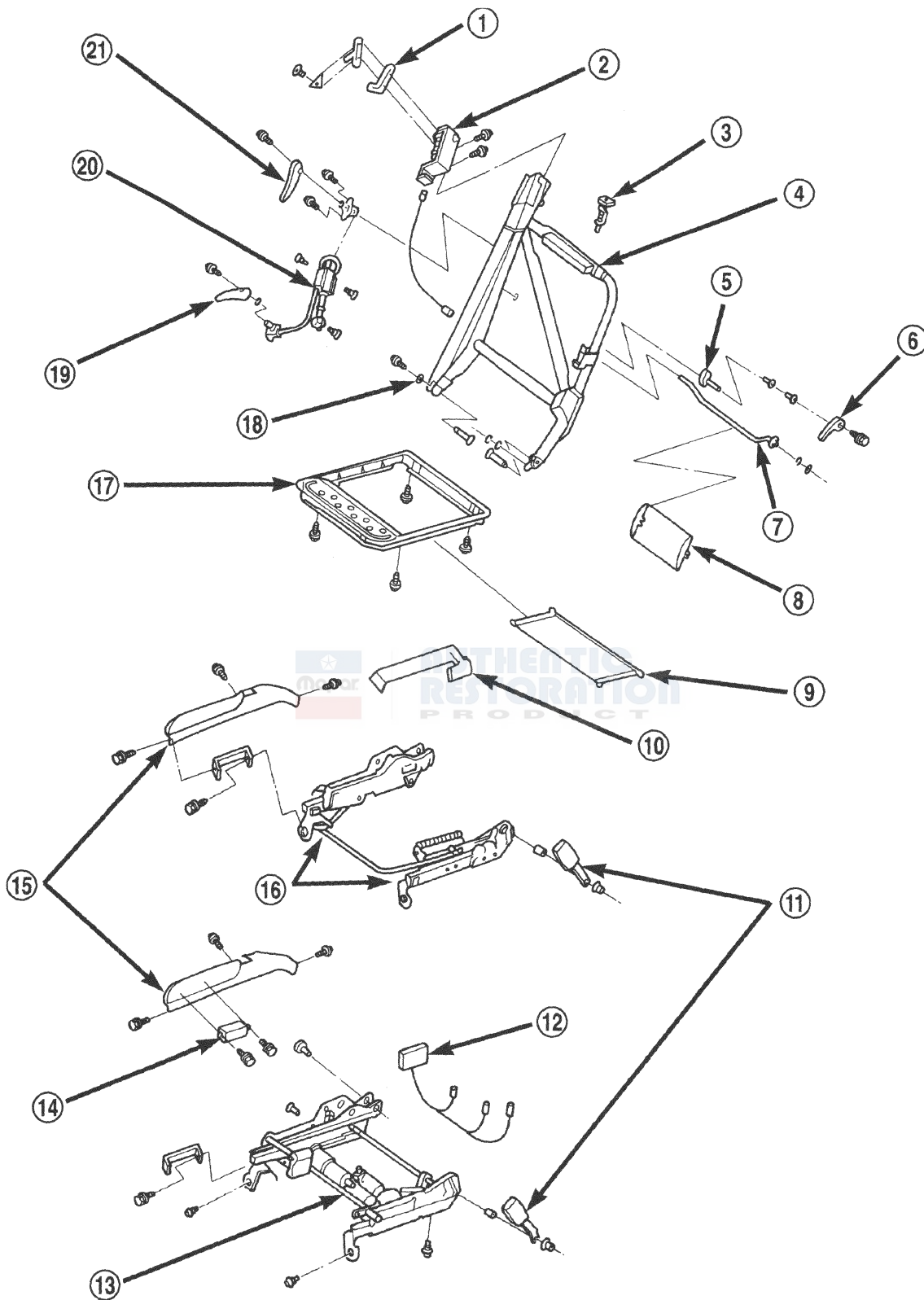
DESCRIPTION AND OPERATION

FRONT SEAT

DESCRIPTION

Refer to (Fig. 1) for more information while servicing the front seat.



**DESCRIPTION AND OPERATION (Continued)**

**Fig. 1 Front Seat Exploded Diagram**



**DESCRIPTION AND OPERATION (Continued)**

- |                              |                                    |
|------------------------------|------------------------------------|
| 1 – SEAT BELT TRIM BEZEL     | 12 – POWER SEAT WIRING HARNESS     |
| 2 – SEAT BELT RETRACTOR      | 13 – POWER SEAT ADJUSTER ASSEMBLY  |
| 3 – HEADREST SLEEVE          | 14 – POWER SEAT SWITCH             |
| 4 – SEAT BACK FRAME ASSEMBLY | 15 – SEAT SIDE SHIELD              |
| 5 – LUMBAR CAM ASSEMBLY      | 16 – MANUAL SEAT ADJUSTER ASSEMBLY |
| 6 – LUMBAR HANDLE            | 17 – CUSHION FRAME ASSEMBLY        |
| 7 – LUMBAR ROD ASSEMBLY      | 18 – MEMORY DUMP CAM               |
| 8 – LUMBAR BACKREST          | 19 – LOWER RECLINER HANDLE         |
| 9 – SEAT SUSPENSION          | 20 – RECLINER ASSEMBLY             |
| 10 – CARPET SHIELD           | 21 – UPPER RECLINER HANDLE         |
| 11 – FRONT SEAT BELT BUCKLE  |                                    |
- 

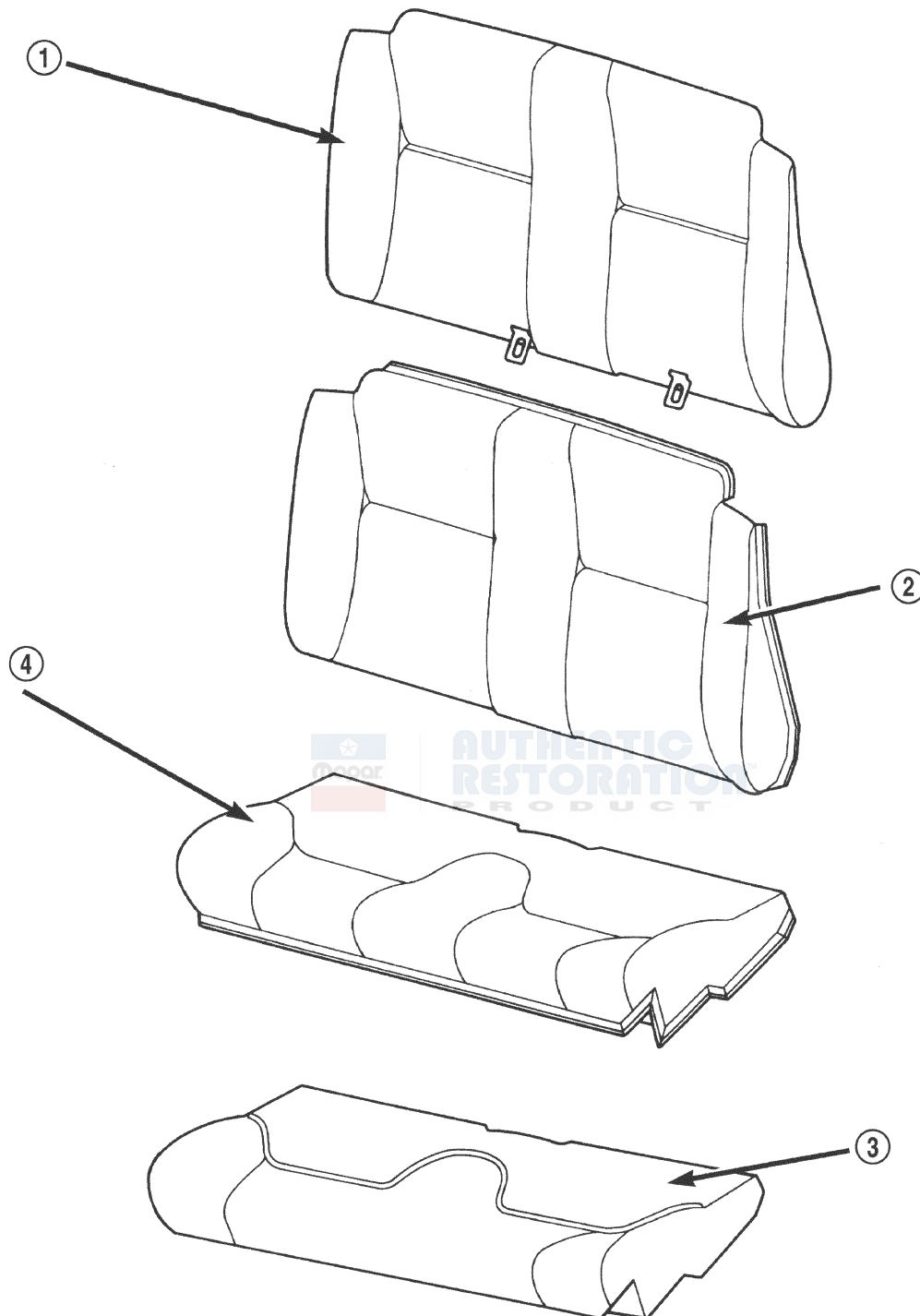
**REAR SEAT****DESCRIPTION**

Refer to (Fig. 2) for more information while servicing the rear seat.



**AUTHENTIC  
RESTORATION™**  
PRODUCT

## DESCRIPTION AND OPERATION (Continued)

**Fig. 2 Rear Seat Covers**

80a01416

1 - VINYL/LEATHER  
2 - CLOTH

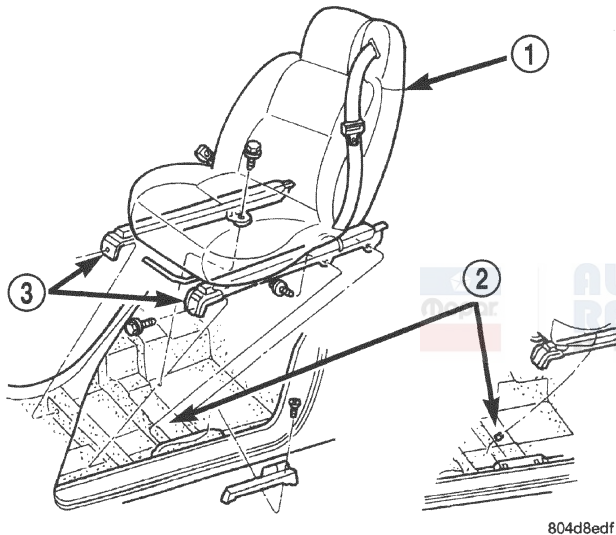
3 - CLOTH  
4 - VINYL/LEATHER

## REMOVAL AND INSTALLATION

### MANUAL FRONT SEAT

#### REMOVAL

- (1) Position seat in full rearward position.
- (2) Remove front inboard and outboard bolts holding seat to floor pan crossmember (Fig. 3).
- (3) Move seat to full forward position.
- (4) Remove rear inboard bolt attaching seat to floor pan.
- (5) Remove rear outboard bolts attaching seat to side sill pylon.
- (6) Tilt seat forward and disconnect wire connector to seat belt retractor.
- (7) Remove seat from vehicle.



**Fig. 3 Front Seat**

- 1 - FRONT SEAT  
2 - FLOOR PAN CROSSMEMBER  
3 - FRONT SEAT TRACK

#### INSTALLATION

**CAUTION:** It is important that the following steps be done correctly to insure that the seat tracks are properly timed prior to securing the seats to the vehicle.

- (1) Adjust seat back to vertical position using either recliner handle.

**NOTE:** Do not grab either recliner handle or towel bar when handling seat. The seat tracks are spring loaded and will release.

- (2) Turn seat on its side with the bottom of the seat facing so that the seat tracks can be seen.

- (3) Securely grasp the spring loaded track and while lifting the towel bar, allow the seat track to move to the full rearward position. The seat track is in the full rearward position if the first and last latch pins are engaged into the seat track.

- (4) Position the other seat track in the full rearward position. The first and last latch pins should also be engaged.

- (5) Return seat to upright position.
- (6) Position seat in vehicle.
- (7) Tilt seat forward and connect wire connector to seat belt retractor.

- (8) Push downward on seat cushion to ensure that the front mounting brackets are fully seated to floor pan crossmember.

- (9) Install and tighten rear outboard bolt holding seat to side sill pylon.

- (10) Install and tighten forward rear outboard bolt holding seat to side sill pylon.

- (11) Install and tighten rear inboard bolt holding seat to floor pan.

- (12) Move seat to full rearward position. Push rearward slightly on seat to ensure that the adjuster latches are engaged on both seat tracks.

- (13) Install and tighten front inboard bolt holding seat to floor pan crossmember.

- (14) Install and tighten front outboard bolt holding seat to floor pan crossmember.

**NOTE:** Tighten all seat retaining bolts to 61 N-m (45 ft. lbs.) torque.

### POWER FRONT SEAT

#### REMOVAL

- (1) Position seat in full rearward position.
- (2) Remove front inboard and outboard bolts holding seat to floor pan crossmember (Fig. 3).
- (3) Move seat to full forward position.
- (4) Remove rear inboard bolt holding seat to floor pan.
- (5) Remove rear outboard bolts holding seat to side sill pylon.
- (6) Tilt seat forward and disconnect wire connector to seat belt retractor and power seat mechanism.
- (7) Remove seat from vehicle.

#### INSTALLATION

- (1) Adjust seat back to vertical position using either recliner handle.
- (2) Position seat in vehicle.
- (3) Tilt seat forward and connect wire connector to seat belt retractor and power seat mechanism.
- (4) Push downward on seat cushion to ensure that the front mounting brackets are fully seated to floor pan crossmember.

## REMOVAL AND INSTALLATION (Continued)

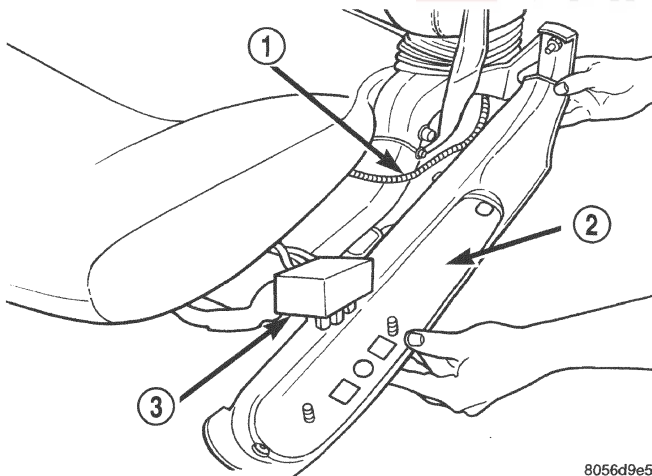
- (5) Use power seat switch to move seat to full forward position.
- (6) Install and tighten rear outboard bolt holding seat to side sill pylon.
- (7) Install and tighten center outboard bolt holding seat to side sill pylon.
- (8) Install and tighten rear inboard bolt holding seat to floor pan.
- (9) Use power seat switch to move seat to full rearward position.
- (10) Install and tighten front inboard bolt holding seat to floor pan crossmember.
- (11) Install and tighten front outboard bolt holding seat to floor pan crossmember.

**NOTE:** Tighten all seat retaining bolts to 61 N·m (45 ft. lbs.) torque.

## FRONT SEAT SIDE SHIELD

### REMOVAL

- (1) Remove lower recliner handle.
- (2) Remove screws holding seat side shield to seat frame.
- (3) Remove screws holding power seat switch to side shield, if so equipped.
- (4) Separate side shield from vehicle (Fig. 4).



**Fig. 4 Front Seat Side Shield**

- 1 - SEAT FRAME
- 2 - SEAT SIDE SHIELD
- 3 - POWER SEAT SWITCH

### INSTALLATION

- (1) Position side shield near seat.
- (2) Install screws holding power seat switch to side shield, if so equipped.
- (3) Install screws holding side shield to seat frame.
- (4) Install lower recliner handle.

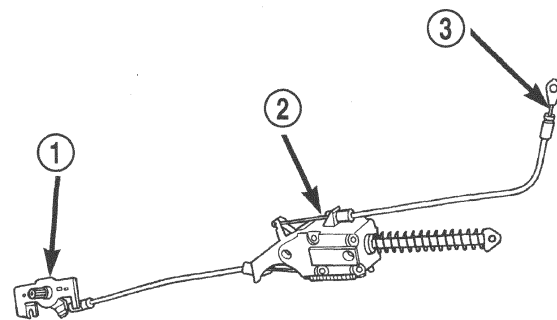
## FRONT SEAT RECLINER

### REMOVAL

- (1) Remove seat from vehicle. Refer to appropriate procedure found in this section.
- (2) Clamp the shoulder belt at seat belt bezel (Fig. 7), or the belt will wind up on the retractor and locked. If the belt is wound up and lock on the retractor, apply 12 volts to the retractor to release the belt. For a power source use the retractor connector in the vehicle or a 12 volt battery supply.
- (3) Remove seat back from lower seat frame.
- (4) Remove upper recliner handle.
- (5) Remove seat back cover until the screws holding the upper recliner mechanism to the seat back frame can be accessed.
- (6) Remove rubber bellows covering lower part of seat back frame.
- (7) Remove screws holding upper recliner mechanism to seat frame.
- (8) Remove bolts attaching recliner housing to seat frame.
- (9) Push upper recliner mechanism into seat frame with handle shaft facing the front of the seat frame.

**NOTE:** Do not reuse bolts holding recliner housing to seat frame. Verify availability prior to proceeding.

- (10) Pull recliner housing and upper recliner handle mechanism downward and out through bottom of seat frame (Fig. 5).



**Fig. 5 Recliner Housing**

- 1 - UPPER RECLINER MECHANISM
- 2 - RECLINER HOUSING
- 3 - RECLINER CABLE

### INSTALLATION

- (1) Feed upper recliner mechanism and then recliner housing into the seat back frame with handle shaft facing the front of the seat frame.



**REMOVAL AND INSTALLATION (Continued)**

(2) Install new bolts to hold seat recliner housing to seat frame. Tighten to 34 N·m (300 in. lbs.) torque.

(3) Pull upper recliner mechanism through hole in seat frame.

(4) Install screws attaching upper recliner mechanism to seat frame.

(5) Install rubber bellows covering lower part of seat back frame.

(6) Install seat back cover.

(7) Install recliner spring bracket, spring, and lead screw.

(8) Install seat back to lower seat frame.

(9) Install recliner handle.

(10) Install seat into vehicle.

**FRONT SEAT BACK****REMOVAL**

(1) Remove seat from vehicle. Refer to appropriate procedure found in this section.

(2) Remove seat side shield.

(3) Remove wiring tie strap.

(4) Remove recliner cable eyelet clip (Fig. 6).

(5) Remove recliner cable from arm on seat adjuster and feed cable back through hole in seat adjuster.

**NOTE:** The torque prevailing nuts used to secure the lower seat belt anchor and seat belt buckle are not reusable. Verify availability prior to proceeding.

(6) Remove seat cushion assembly.

(7) Clamp the shoulder belt at seat belt bezel (Fig. 7), or the belt will retract completely and lock. If the belt is completely retract and locks on the retractor, apply 12 volts to the retractor to release the belt. For a power source use the retractor connector in the vehicle or a 12 volt battery supply.

(8) Remove nut holding lower seat belt anchor to seat frame (Fig. 6).

(9) Remove nut and washer holding seat belt buckle to seat frame.

(10) Remove seat belt buckle from seat frame.

(11) Remove E-clip and washer from easy-entry rod at inboard side of seat, manual seat only.

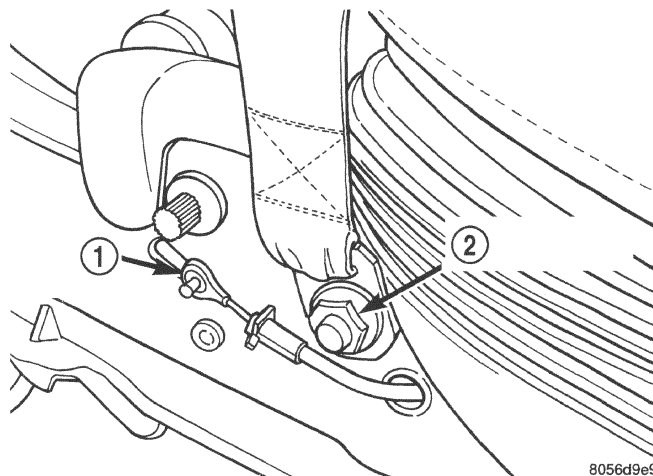
(12) Remove rod from seat back, manual seat only.

(13) Remove pivot bolts holding seat back to seat frame.

**WARNING:** Do not pull on upper recliner handle or recliner cable end at any point until the lead screw is removed it is under a high pressure load.

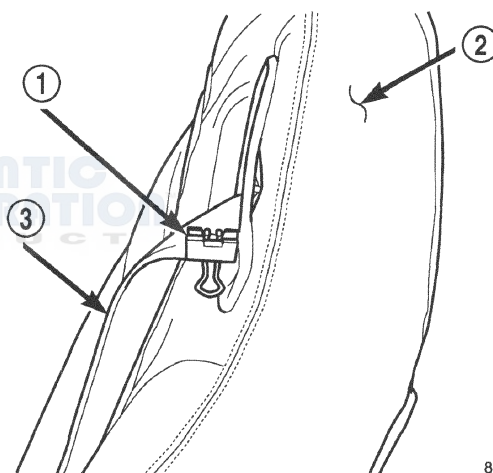
(14) Remove bolt holding recliner lead screw to seat frame.

(15) Remove seat back from seat frame.



**Fig. 6 Lower Seat Belt Anchor And Recliner Cable**

- 1 - RECLINER CABLE
- 2 - LOWER SEAT BELT ANCHOR



**Fig. 7 Clamp Shoulder Belt**

- 1 - CLAMP
- 2 - SEAT BACK
- 3 - SHOULDER BELT

(16) Unscrew lead screw from recliner mechanism (Fig. 8).

(17) Remove wire connector for seat belt retractor by separating wire connector from push-in fastener located on bracket under seat cushion.

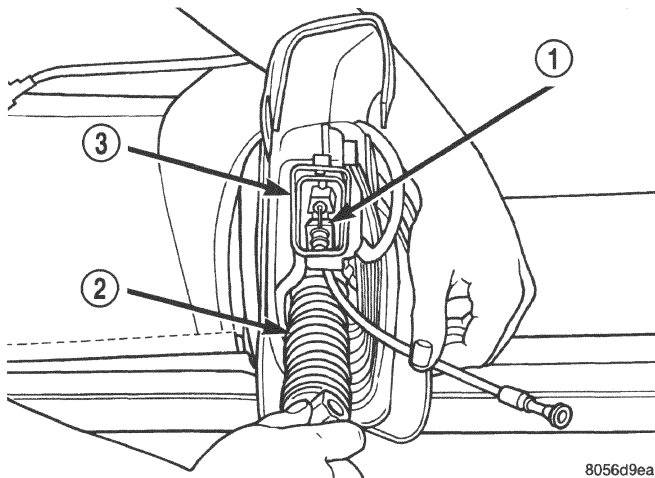
(18) Remove lead screw, spring and spring plate (Fig. 9).

**INSTALLATION**

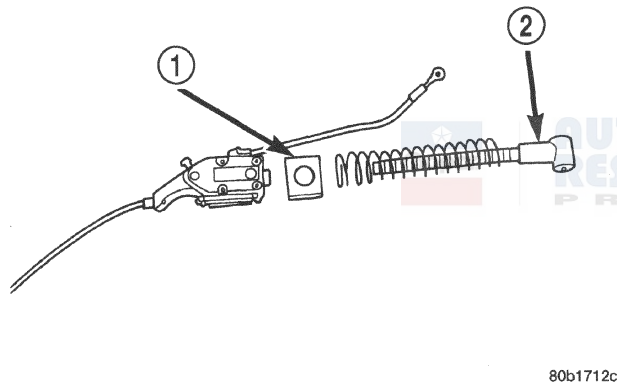
(1) Screw recliner lead screw into recliner mechanism. (Fig. 8).

**WARNING:** Do not pull on upper recliner handle or recliner cable end at any point until the lead screw is removed.

## REMOVAL AND INSTALLATION (Continued)

**Fig. 8 Recliner Lead Screw**

- 1 - RECLINER MECHANISM
- 2 - LEAD SCREW
- 3 - SEAT FRAME

**Fig. 9 Recliner Lead Screw**

- 1 - LEAD SCREW SPRING PLATE
- 2 - LEAD SCREW

(2) Route recliner cable in front of metal strap at bottom of the seat back frame (Fig. 10).

(3) Position seat back to seat frame.

(4) Install wire connector for seat belt retractor to bracket located under seat cushion.

(5) Install wiring tie strap holding retractor wiring harness to recliner cable.

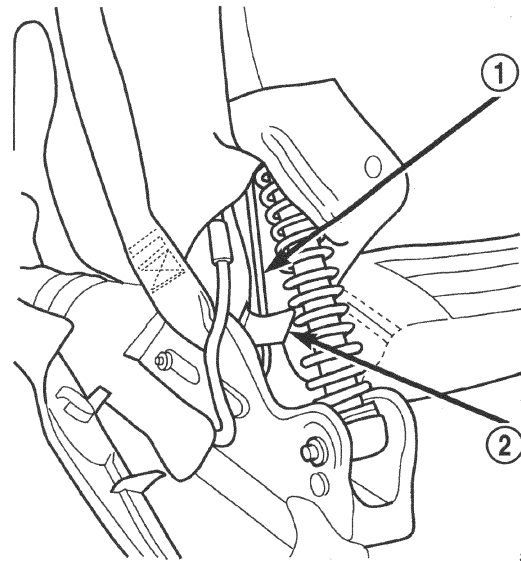
(6) Install bolt attaching recliner lead screw to seat frame. Tighten bolt to 45.3 N·m (33.3 ft. lbs.) torque.

(7) Install pivot bolts attaching seat back to seat frame. Tighten bolts to 51.0 N·m (33.3 ft. lbs.) torque.

(8) Attach easy-entry rod to seat back, passenger side only.

(9) Install easy-entry washer and E-clip, passenger side only.

(10) Install seat cushion.

**Fig. 10 Route Recliner Cable**

- 1 - NEW CABLE ROUTING (DRIVER SEAT)
- 2 - BACK FRAME STRAP

(11) Feed recliner cable through hole in seat adjuster and engage cable eyelet to arm on seat adjuster.

(12) Install new recliner cable eyelet clip to arm on seat frame (Fig. 6).

(13) Position seat belt buckle washer to bolt on side of seat adjuster.

(14) Position seat belt buckle to bolt on side of seat adjuster and install nut.

(15) Install new nut to hold seat belt buckle to seat adjuster.

(16) Position lower seat belt anchor to bolt on seat adjuster.

(17) Verify that seat belt is routed such that it will not be twisted when engaged to the seat belt buckle.

(18) Install new nut holding lower seat belt anchor to seat frame (Fig. 6).

**NOTE: The tighten the lower seat belt anchor and seat belt buckle nuts to 45.3 N·m (33.3 ft. lbs.) torque.**

**NOTE: Verify that a minimum of three threads extend beyond the lower seat belt anchor nut and that the lower seat belt anchor swivels freely. If both conditions are not found, remove nut, torque bolt, and while preventing bolt from turning, torque nut.**

(19) Install seat side shield. Verify that side and rear screws go through the rubber bellows.

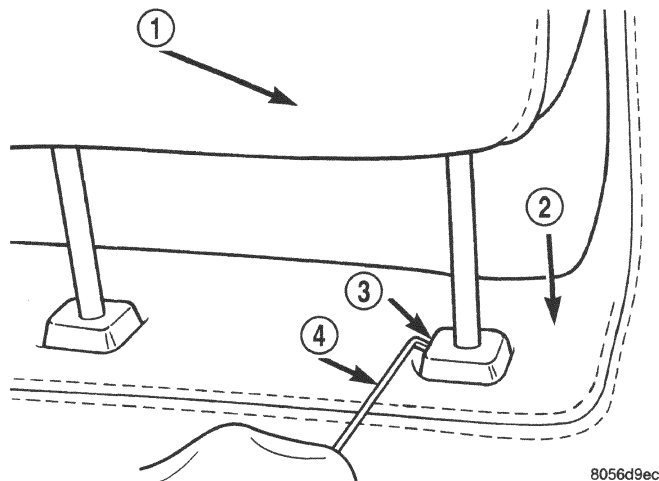
(20) Install seat to vehicle. Refer to procedures found in this section.

**REMOVAL AND INSTALLATION (Continued)****FRONT SEAT BACK COVER****REMOVAL**

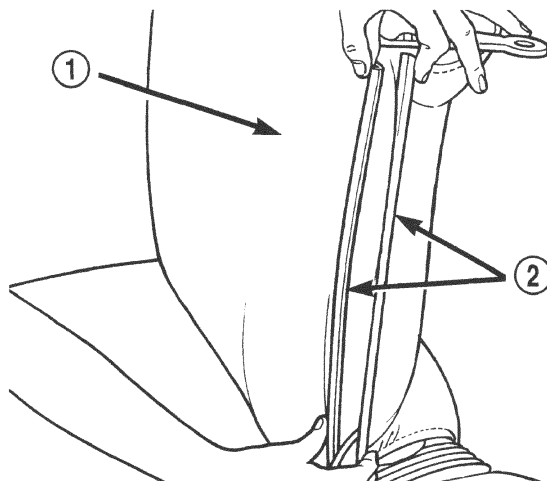
- (1) Remove seat from vehicle.
- (2) Remove head restraint (Fig. 11) by depressing headrest button and using a pick tool in access hole simultaneously.
- (3) Remove seat back.
- (4) Remove upper recliner handle and lumbar adjustment handle, if so equipped.
- (5) Remove seat side shield.
- (6) Remove nut attaching lower seat belt anchor to seat frame (Fig. 6).
- (7) Remove seat belt bezel.

**NOTE:** The torque prevailing nut used to secure the lower seat belt anchor is not reusable. Verify availability prior to proceeding.

- (8) Remove plastic J-strip retainer at bottom of seat back (Fig. 12).
- (9) Remove hog rings holding seat cover seam cords to wires in seat back foam (Fig. 13) and (Fig. 14).
- (10) Pull seat cover upward to mid point position (Fig. 15).
- (11) Feed seat belt bezel and seat belt through seat cover while pulling cover from seat back foam.
- (12) Remove hog rings attaching the seat cover seam cords and wires to seat back foam.
- (13) Remove head restraint guides (Fig. 16).
- (14) Remove seat back cover from seat back foam and frame.

**Fig. 11 Head Restraint Removal**

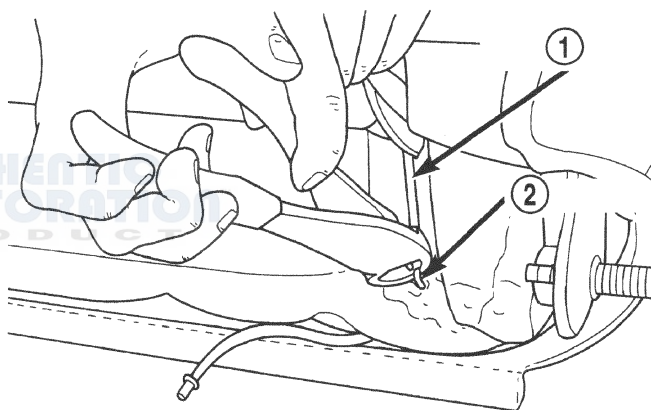
- 1 - HEADREST
- 2 - SEAT
- 3 - ACCESS HOLE
- 4 - PICK TOOL



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**Fig. 12 Seat Cover Retainer Strip**

- 1 - SEAT BACK
- 2 - PLASTIC RETAINER STRIP



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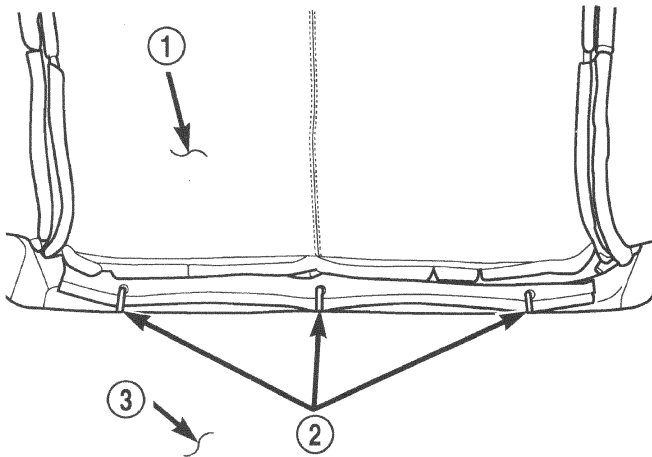
**Fig. 13 Hog Rings**

- 1 - SEAT COVER SEAM STRAP
- 2 - HOG RING

**INSTALLATION**

- (1) Position seat back cover on to seat back foam and frame.
- (2) Install head restraint guides
- (3) Install hog rings attaching seat back foam to seat back frame.
- (4) Feed seat belt bezel and seat belt through hole in seat cover.
- (5) Route recliner cable in front of metal strap at bottom of the seat back frame (Fig. 10).
- (6) Pull seat cover downward to first horizontal trench in seat back foam.
- (7) Align seat cover horizontal seam center notch to center hog ring location.
- (8) Install hog rings, center first, to hold seat back cover seam wire to wire in seat back foam.

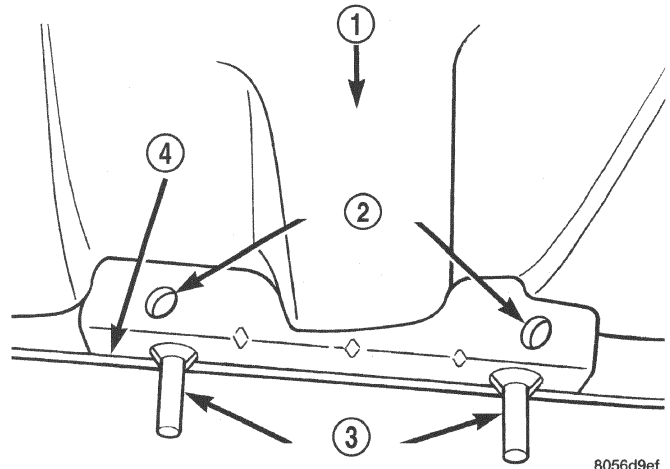


**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 14 Lower Seat Hog Rings**

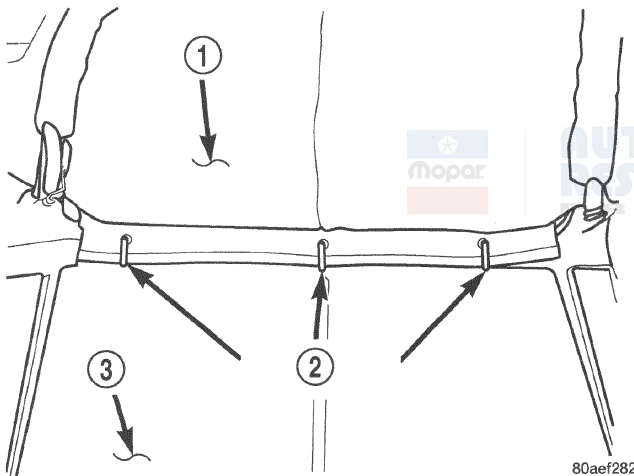
- 1 - SEAT BACK COVER
- 2 - HOG RING
- 3 - SEAT BACK CUSHION



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**Fig. 16 Head Restraint Guides**

- 1 - SEAT CUSHION
- 2 - ACCESS HOLES
- 3 - HEADREST GUIDES
- 4 - BOTTOM OF TOP SEAT FRAME RAIL



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**Fig. 15 Mid Seat Back Hog Rings**

- 1 - CUSHION COVER
- 2 - HOG RINGS
- 3 - CUSHION

(9) Install hog rings at hog ring location in vertical foam trenches to attach the cover seam cords to the wires in the foam. If vehicle is equipped with cloth seats, attach the lower ends of horse shoe shaped wire with the same hog rings.

(10) Install hog rings to hold seat cover seam cords to wires in seat back foam.

(11) Pull seat cover down fully over seat back foam.

(12) Install hog rings above bead in seat cover seam cord to hold cords to hog ring location at bottom of vertical foam trench.

(13) Connect seat cover J- strips at bottom of seat back.

(14) Slide long snaps on outboard portion of seat belt bezel inside seat back cover and seat belt retractor cover.

(15) Install upper recliner handle and lumbar adjustment handle, if so equipped.

(16) Attach lower seat belt anchor to bolt on seat adjuster.

(17) Verify that seat belt is routed such that it will not be twisted when engaged to the seat belt buckle.

(18) Install new nut holding lower seat belt anchor to seat frame (Fig. 6).

**NOTE: The tighten the lower seat belt anchor nut to 45.3 N·m (33.3 ft. lbs.) torque.**

(19) Verify that a minimum of three threads extend beyond the lower seat belt anchor nut and that the lower seat belt anchor swivels freely. If both conditions are not found, check that the bolt is fully engaged to the seat adjuster.

(20) Install seat to vehicle.

(21) Check seat belt operation.

**FRONT SEAT CUSHION ASSEMBLY****REMOVAL**

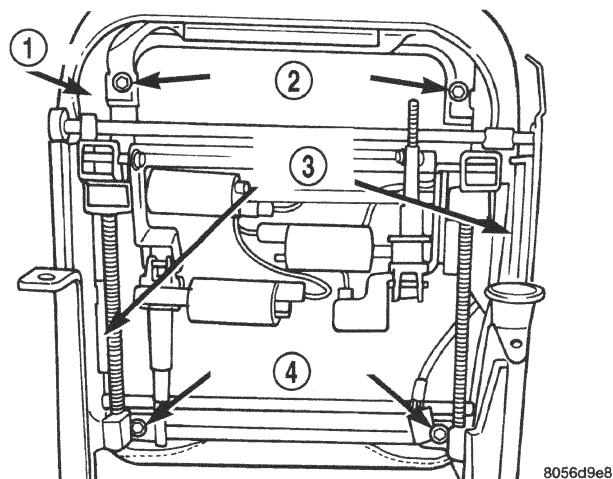
(1) Remove seat from vehicle. Refer to procedures found in this section.

(2) Invert seat on a suitable work surface.

(3) Remove fasteners holding seat cushion assembly to seat adjusters (Fig. 17).

(4) Separate seat cushion assembly from seat adjusters.



**REMOVAL AND INSTALLATION (Continued)****Fig. 17 Front Seat Cushion**

- 1 - SEAT CUSHION
- 2 - FASTENERS
- 3 - SEAT FRAME
- 4 - FASTENERS

**INSTALLATION**

- (1) Position seat cushion assembly on seat adjusters.
- (2) Install fasteners holding seat cushion assembly to seat adjusters.
- (3) Install seat in vehicle. Refer to procedures found in this section.

**FRONT SEAT CUSHION COVER****REMOVAL**

- (1) Remove seat cushion assembly.
- (2) Disengage seat cushion cover retainer channels from seat cushion frame.
- (3) Peel seat cushion cover back from seat cushion foam to access hog rings holding seat cushion cover to seat cushion foam.
- (4) Remove hog rings holding seat cushion cover to seat cushion foam.
- (5) Separate seat cushion cover from seat cushion foam.

**INSTALLATION**

- (1) Position seat cushion foam to seat cushion frame.
- (2) Wrap fabric flap on bottom of cushion foam behind and under rear rail of cushion frame. Pull fabric tight.
- (3) Install hog rings to hold fabric flap to seat cushion frame.
- (4) Position seat cushion cover to seat cushion foam.

(5) Align horizontal seat cushion cover seam center notch with center hog ring location in seat cushion foam.

(6) Install hog rings to hold horizontal seam wire to wire in seat cushion foam at each hog ring location provided. Begin at center hog ring location and work outward.

(7) Install hog rings to hold vertical seam wires to wires in seat cushion foam at each hog ring location provided, if seat has vertical seams.

(8) Pull cushion cover down over seat cushion foam and frame.

(9) Engage seat cushion cover retainer channels to seat frame.

(10) Install seat cushion assembly.

**MANUAL SEAT ADJUSTERS****REMOVAL**

- (1) Remove seat from vehicle. Refer to appropriate procedure in this section.
- (2) Remove front seat back.
- (3) Remove towel bar spring.
- (4) Remove push-nuts attaching towel bar to seat adjusters.
- (5) Remove towel bar from seat adjuster.
- (6) Remove seat adjusters.

**INSTALLATION**

- (1) Position seat adjusters for reassembly.
- (2) Install towel bar to seat adjusters.
- (3) Install new push nuts to attach towel bar to seat adjusters.
- (4) Install towel bar spring.
- (5) Install front seat back.
- (6) Install seat in vehicle. Refer to appropriate procedure in this section.

**POWER SEAT ADJUSTER****REMOVAL**

- (1) Remove seat from vehicle. Refer to appropriate procedure in this section.
- (2) Remove front seat back.
- (3) Remove power seat switch and harness from seat adjuster.

**INSTALLATION**

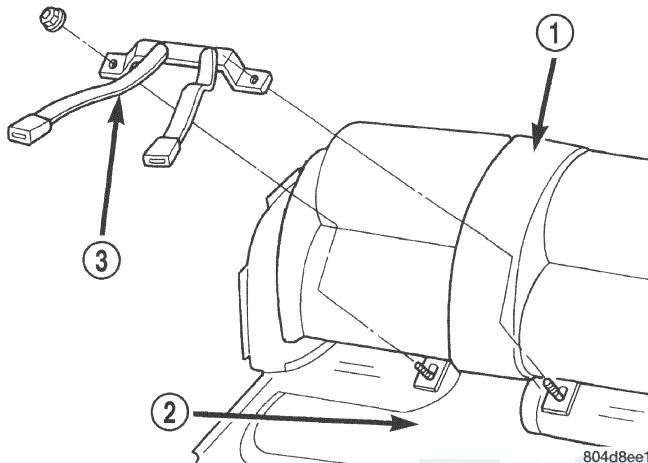
- (1) Install power seat switch and harness to seat adjuster.
- (2) Install front seat back.
- (3) Install seat in vehicle. Refer to appropriate procedure in this section.

## REMOVAL AND INSTALLATION (Continued)

### REAR SEAT BACK

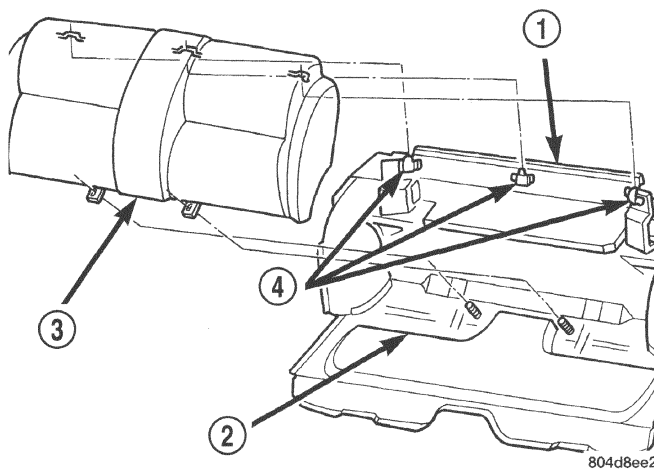
#### REMOVAL

- (1) Remove rear seat cushion.
- (2) Remove rear inner seat belt assembly (Fig. 18).
- (3) Pull bottom of rear seat back forward until seat back brackets clear studs on floor pan (Fig. 19).
- (4) Push upward on rear seat back and disengage hooks holding seat back to rear seat back support.
- (5) Remove rear seat back from vehicle.



**Fig. 18 Rear Inner Seat Belt Assembly**

- 1 - REAR SEAT BACK  
2 - FLOOR PAN  
3 - INNER SEAT BELT ASSEMBLY



**Fig. 19 Rear Seat Back**

- 1 - REAR SEAT BACK SUPPORT  
2 - FLOOR PAN  
3 - REAR SEAT BACK  
4 - RETAINING BRACKET

#### INSTALLATION

- (1) Position rear seat back in vehicle.
- (2) Tilt rear seat back rearward and raise seat back above retaining brackets on rear seat back support.

(3) Lower rear seat back until center loop begins to engage.

(4) Lower rear seat back and push rearward on outboard corners of seat back to engage outboard hooks to brackets on rear seat back support.

(5) Push downward on rear seat back until all hooks are fully engaged into retaining brackets.

(6) Install rear inner seat belt assembly.

(7) Install rear seat cushion.

**NOTE: Tighten the rear inner seat belt assembly to 40 N·m (350 in. lbs.) torque.**

### REAR SEAT BACK COVER

#### REMOVAL

(1) Remove rear seat back from vehicle. Refer to procedures found in this section.

(2) Place seat back on a suitable work surface in inverted position.

(3) Remove hog rings around perimeter of seat back holding seat back cover to seat back frame.

(4) Pull seat cover from seat back frame and seat back foam.

(5) Remove any hog rings holding seat cover seam wires to seat foam wires.

(6) Separate seat cover from seat frame and seat back foam.

#### INSTALLATION

(1) Position seat cover to seat back frame and seat back foam.

(2) Align notch in center of seat back cover vertical seam to center hog ring locator.

(3) Install a hog ring at each hog ring location, center first, to hold seat back cover seam to wires in seat back foam.

(4) Repeat the above steps for the opposite inboard vertical seam, both outboard vertical seams, and the lower horizontal seam.

(5) If vehicle is equipped with cloth seats;

(a) Install hog rings at each hog ring locator, center first, to attach ends of vertical portions of U-shaped wires to vertical foam wires.

(b) Align notch in center of upper horizontal seat cover seam to center hog ring location.

(c) Install a hog ring at each hog ring locator to hold upper horizontal seam wire to wire in seat back foam.

(6) Install hog rings holding seat cover seam wires to seat frame.

(7) Pull seat cover over seat back frame and seat back foam.

(8) Install hog rings at hog ring locators around perimeter of seat back cushion holding seat cover to seat back frame.

**REMOVAL AND INSTALLATION (Continued)**

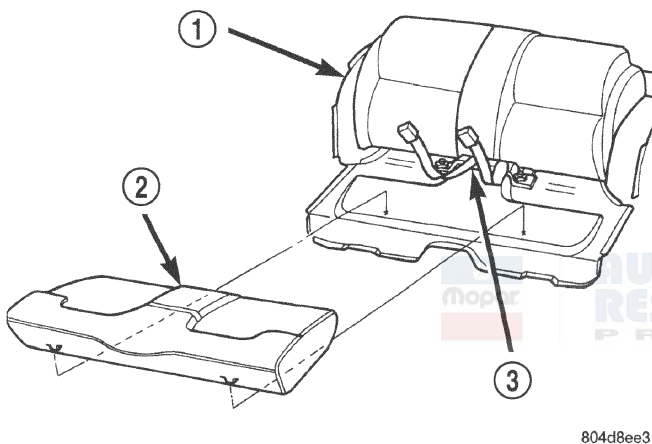
(9) Install rear seat back to vehicle. Refer to procedures found in this section.

**REAR SEAT CUSHION**

**NOTE:** Special care should be taken when removing rear seat cushion to prevent damage to the cushion frame. Remove cushion at attachment areas, not at wing area.

**REMOVAL**

- (1) Push firmly rearward and upward at one attachment point and disengage wire loops from retainers in floor pan (Fig. 20).
- (2) Repeat for other attachment point.
- (3) Separate rear seat cushion from vehicle.



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**Fig. 20 Rear Seat Cushion**

- 1 - REAR SEAT BACK  
2 - REAR SEAT CUSHION  
3 - INNER SEAT BELTS

**INSTALLATION**

- (1) Position rear seat cushion in vehicle.
- (2) Place inner seat belts on top of seat cushion.
- (3) Push seat cushion rearward and align wire loops to retainers in floor pan.
- (4) Push rear seat cushion firmly downward and engage wire loops to retainers in floor pan.

**REAR SEAT CUSHION COVER****REMOVAL**

- (1) Remove rear seat cushion from vehicle. Refer to procedures found in this section.
- (2) Place seat cushion on a suitable work surface in inverted position.
- (3) Remove hog rings around perimeter of seat cushion attaching seat cushion cover to seat cushion frame.
- (4) Pull seat cover from seat cushion frame and seat cushion foam.
- (5) Remove hog rings attaching seat cover seam wires to seat foam wires.
- (6) Remove seat cover from seat frame and seat cushion foam.

**INSTALLATION**

- (1) Position seat cushion cover to seat cushion frame and seat cushion foam.
- (2) If vehicle is equipped with cloth seats;
  - (a) Align notch in center of seat cushion cover seam to center hog ring locator.
  - (b) Install a hog ring at each hog ring location to attach seat cushion cover seam wires to wires in seat cushion foam. Begin at center location and work outward.
- (3) If vehicle is equipped with leather/vinyl seats;
  - (a) Align notch in center of inboard vertical cover seam with center hog ring locator.
  - (b) Install a hog ring at each hog ring location, beginning at center location, to attach seat cushion cover seam wire to wire in seat cushion foam.
  - (c) Repeat above steps for opposite inboard vertical seam, both outboard vertical seams, and for the horizontal seams.
- (4) Pull seat cover over seat cushion frame and seat cushion foam.
- (5) Install hog rings at hog ring locators around perimeter of seat cushion foam attaching seat cushion cover to seat cushion frame.
- (6) Install rear seat cushion to vehicle. Refer to procedures found in this section.



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## DIAGNOSIS AND TESTING

### HYDRAULIC SYSTEMS

The power convertible top hydraulic system consists of;

- Two hydraulic cylinders
- Hydraulic lines
- Electric hydraulic pump and reservoir
- Dual relays

### HYDRAULIC SYSTEM TESTS

**NOTE:** The convertible top will raise slowly or make abnormal noise if the hydraulic fluid level is low.

- (1) Remove rear seat cushion and back.
- (2) With the top down, remove the reservoir fill plug.
- (3) Visually inspect fluid level. If low, inspect for leak in hydraulic system.
- (4) Fill reservoir with Dextron II automatic transmission fluid to the bottom of the fill hole.
- (5) Repair or replace components, as necessary.
- (6) Replace fill plug and raise top.
- (7) Lower top and verify fluid level.

## REMOVAL AND INSTALLATION

### CONVERTIBLE TOP HEADLINING

#### REMOVAL

- (1) Raise convertible top to midway position.
- (2) Remove convertible top header trim panel.
- (3) Remove screws attaching headlining to convertible top header panel.

- (4) Remove push in fasteners attaching headlining to convertible top mechanism rearward of quarter window.
- (5) Remove tack strip trim panel.
- (6) Remove shock cords along both sides of headlining.
- (7) Remove roof bows from convertible top mechanism.
- (8) Slide roof bows from convertible top cover and headlining.
- (9) Remove nuts holding headlining straps to tack strip.
- (10) Disengage hook and loop fasteners holding headlining above rear window.
- (11) Remove headlining from vehicle.

#### INSTALLATION

- (1) Position headlining from vehicle.
- (2) Engage hook and loop fasteners holding headlining above rear window.
- (3) Install nuts attaching headlining straps to tack strip.
- (4) Install roof bows from convertible top mechanism.
- (5) Snap plastic retainer strips on headlining and convertible top cover into channels on roof bows, working from rear bow forward.
- (6) Install shock cords along both sides of headlining.
- (7) Install tack strip trim panel.
- (8) Install push in fasteners attaching headlining to convertible top mechanism rearward of quarter window.
- (9) Install screws attaching headlining to convertible top header panel.
- (10) Install convertible top header trim panel.
- (11) Lower and secure convertible top.



**REMOVAL AND INSTALLATION (Continued)****FOLDING TOP COVER****REMOVAL**

- (1) Release folding top latches and allow top cover to relax.
- (2) Remove tack strip trim panel.
- (3) Remove headlining.
- (4) Remove all convertible top storage area sections.
- (5) Remove nuts holding tack strip to deck panel.
- (6) Remove tack strip from deck panel.

**CAUTION: Cover all painted and upholstered surfaces to avoid damage while performing the following operations.**

- (7) Reposition tack strip above rear deck and quarter panels.
- (8) Using a grease pencil, mark location of outer top cover on rear tack strip to aid installation.
- (9) Remove staples holding top cover to rear tack strip.
- (10) Fold rear of top cover, tack strips and rear window up and over the third (rear) roof bow.
- (11) Remove screws holding roof rail tension cable springs to rear rail behind quarter glass opening.
- (12) Pull side rail rear weatherstrips from weatherstrip retainer channels.
- (13) Remove screws holding rear weatherstrip retainer channels to convertible top mechanism.
- (14) Separate rear weatherstrip retainer channels from vehicle.
- (15) Remove top cover listing from adhesive on roof rail.
- (16) Raise folding top to the mid point.
- (17) Remove screws holding convertible top header feature strip to header panel.
- (18) Mark location of top cover on top header.
- (19) Remove staples holding top cover to header.
- (20) Remove screws in end of roof bow.
- (21) Slide convertible top plastic retainer strips from channels in roof bows.
- (22) Close folding top, do not latch.
- (23) Slide tension cable out of cable pocket.
- (24) Disengage roof rail tension cables from header.
- (25) Remove top cover from vehicle.

**INSTALLATION**

- (1) Position convertible top cover on vehicle.
- (2) Slide tension cable through cable pocket.
- (3) Install rubber plugs holding roof rail tension cable ends into key hole slots in roof rails.
- (4) Install roof bows to convertible top mechanism.

(5) Snap convertible top plastic retainer strips into channels in roof bows, starting at rear bow and working forward.

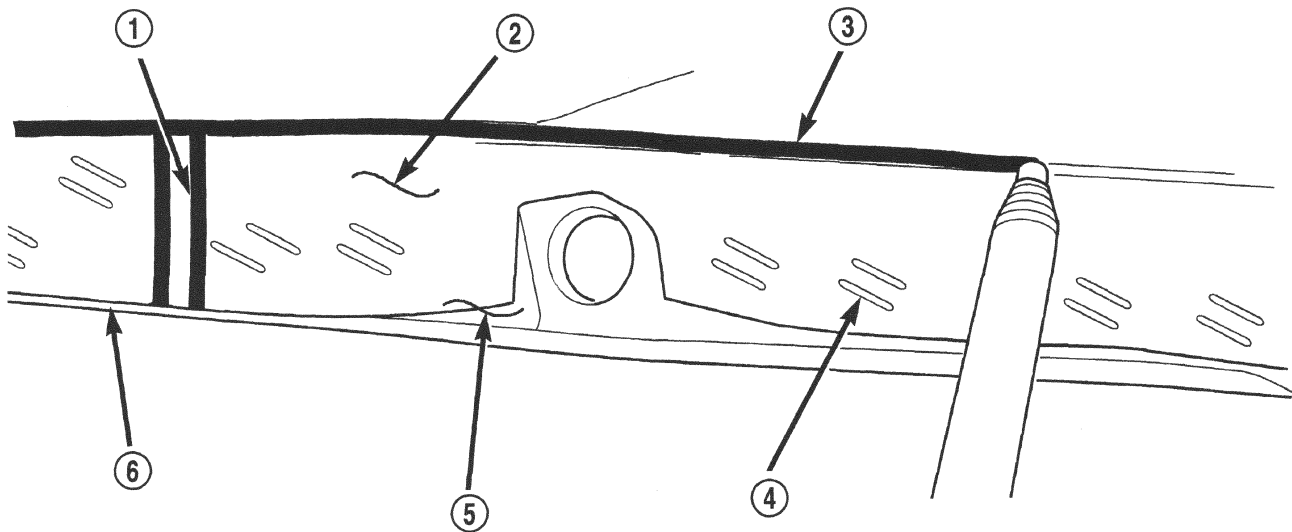
- (6) Install screws at ends of roof bows.
- (7) Raise convertible top to mid point.
- (8) Align top cover to mark made previously on header.
- (9) Install staples to hold top cover to header. The header uses both 3/16 and 1/4 inch staples. The 3/16 staples are used everywhere except the outboard corners where the blinding wraps around, at that point the 1/4 inch staple is used.
- (10) Install screws holding convertible top header feature strip to header panel.
- (11) Install screws holding roof rail tension cable springs to roof rear roof rail behind quarter glass opening.
- (12) Align mark made on rear of top cover and rear window to tack strip.
- (13) Install staples holding rear of top cover and rear window to tack strip.
- (14) Position tack strip to rear deck panel.
- (15) Install nuts holding tack strip to rear deck panel.
- (16) Install headlining.
- (17) Install all convertible top storage area sections.
- (18) Install tack strip trim panel.
- (19) Lower quarter glass.
- (20) Lower and secure convertible top.
- (21) Apply suitable adhesive to side rail rear section to attach top cover listing.
- (22) Pull top cover listing taut and secure to adhesive on rear side rail.
- (23) Install side rail rear weatherstrip retainer channels.
- (24) Install side rail rear weatherstrips.
- (25) Verify fit and operation. Adjust as necessary.

**CONVERTIBLE TOP REAR WINDOW****REMOVAL**

- (1) Release folding top latches and allow top cover to relax.
- (2) Lift shower curtain and remove push in nuts holding curtain to the studs.

**CAUTION: Take precautions not to tear curtain on the boot shelf during removal.**

- (3) Disengage the headliner at the rear sail panels.
- (4) Disconnect wire connectors from terminals on heated rear window.
- (5) Pull wire harness from sleeves at each side of the rear window.
- (6) Remove nuts attaching belt line tack strips to vehicle.

**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 1 Sail Panel Reference Marks**

- 1 - SEAM REFERENCE MARK
- 2 - COVER ASSEMBLY
- 3 - REFERENCE MARK

- 4 - STAPLES
- 5 - OUTER TACK STRIP
- 6 - SECOND TACK STRIP

**NOTE:** Support top 12 inches above windshield header.

(7) Remove the five piece belt line tack strips and save plastic centering bushings for reinstallation.

**NOTE:** Be sure to note the locations of the plastic centering bushings for installation.

(8) Disengage elastic strap from the third roof bow, if equipped.

(9) Remove antenna mast.

(10) Place protective padding over the entire rear deck area to protect paint. Move tack strips to top of deck opening onto protective padding.

(11) Mark the outer sail panels along the top edges and down the seams between the outer and second tack strips from the outside of top (Fig. 1).

**NOTE:** Reference marks will be used to reinstall the new rear window assembly.

(12) Remove sail panel springs on both sides at the front corners of the cover assembly (Fig. 2).

(13) Remove all staples from the cover assembly.

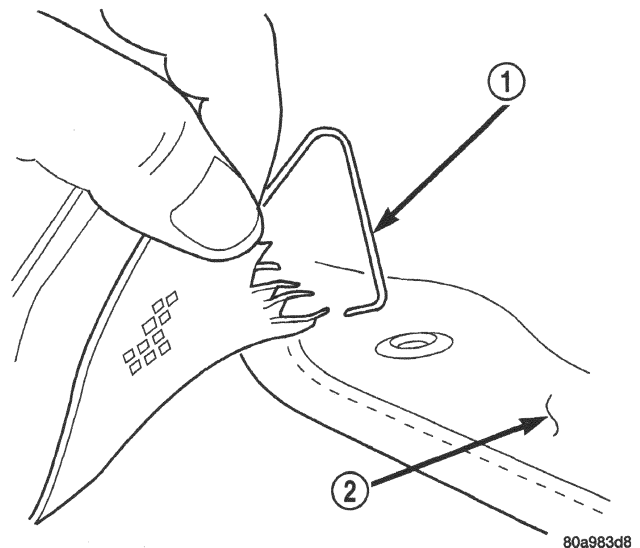
**CAUTION:** Be careful not to tear or damage the cover assembly.

(14) Fold the cover assembly up over the top.

(15) Remove tape and foam at the end of the third roof bow, save if reusable.

(16) Remove the rearmost stop screw on the number three bow, either driver's or passenger's side (Fig. 3).

(17) Slide the old rear window assembly off the number three bow.



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**Fig. 2 Sail Springs**

- 1 - SAIL SPRING
- 2 - COVER ASSEMBLY

## REMOVAL AND INSTALLATION (Continued)

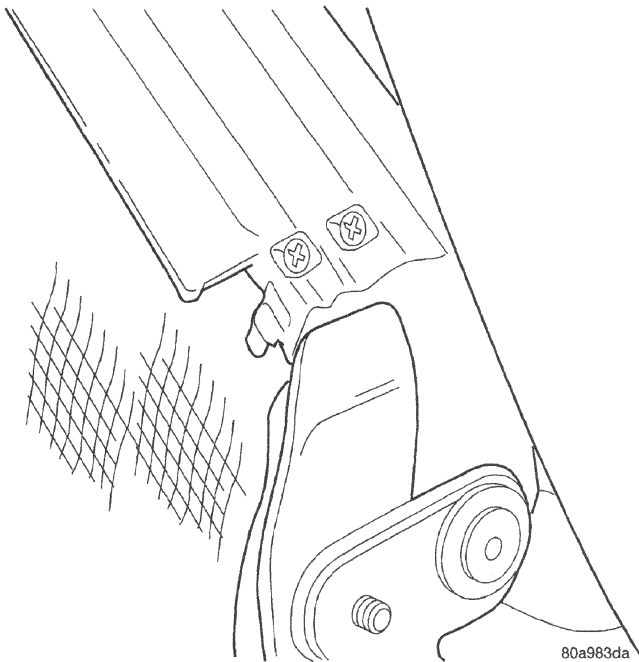


Fig. 3 Rear Window Rear Stop Screw

## INSTALLATION

**NOTE:** To support the new Rear Window assembly for stapling purposes, remove the new rear window from packaging and place shipping box across the top opening, resting on the back seat and decklid.

(1) Remove the boot shelf and two sail springs from the old rear window assembly and install onto the new rear window assembly.

(2) Place rear window locking strip on third bow.

(3) Insert the locking strip into the channel of the number three roof bow. A rubber mallet may be required to set locking strip into channel (Fig. 4).

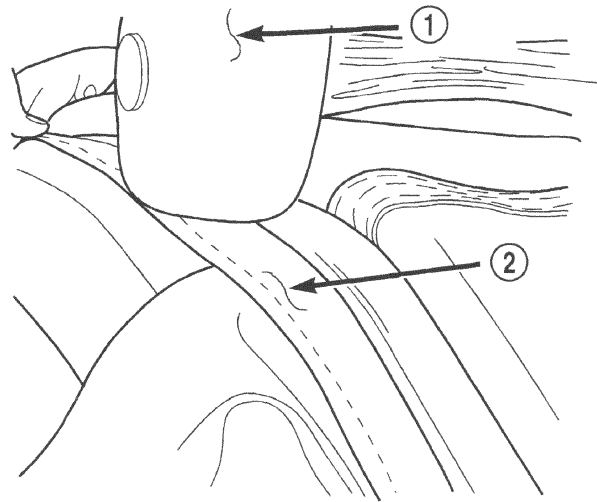
**CAUTION:** Do not slide or pull the locking strip onto the number three bow.

**NOTE:** To ensure rear window is snapped into number three bow, flip assembly onto top to inspect snap in feature.

(4) Install existing or new foam on the end of the bow using 1 in. black tape to secure foam to bow.

(5) Install the rearmost stop screw on the number three bow.

(6) Starting from the right side of the vehicle, locate the front edge of the cover assembly to the tacking strip (use measurements located in the Remove procedures Step 11) and pull cover down until marking is one eighth of an inch below the top edge of the tacking strips.



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Fig. 4 Rear Window Locking Strip

- 1 - RUBBER MALLET  
2 - LOCKING STRIP

**NOTE:** 1/8 inch measurement should be constant when stapling the cover assembly to prevent wrinkles.

(7) Continue to staple right hand cover assembly to tacking strips. Work from the outboard to center line of the vehicle.

(8) Repeat Step 6 for left side of the vehicle.

(9) Install sail panel springs to front of cover assembly.

(10) Install antenna mast.

(11) Engage rear window elastic strap to number three roof bow.

(12) Install plastic centering bushings to the belt line tack strips.

(13) Using the nuts, install the belt line tacking strips, starting with the center tack strip and working outboard.

(14) Feed rear window defogger wire harness through the sleeves at each side of the rear window.

(15) Connect rear window defogger wire connectors to terminals.

(16) Engage the headliner at the rear sail panel.

(17) Install shower curtain with push on nuts.

**CAUTION:** Make sure top well is not trapped under the tack strips.

(18) Latch top and inspect for wrinkles.

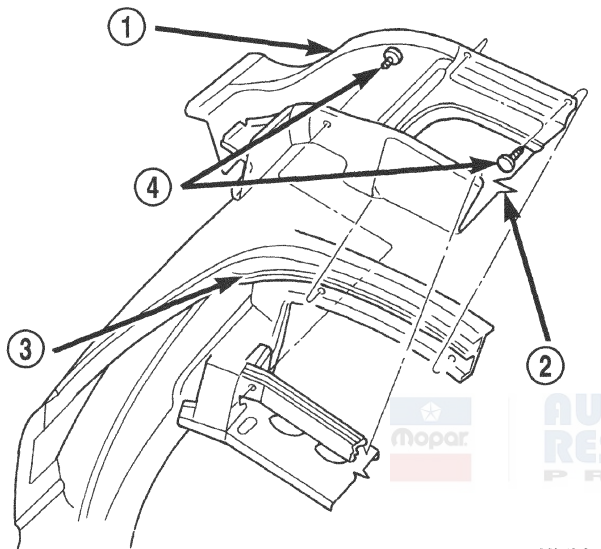


## REMOVAL AND INSTALLATION (Continued)

### CONVERTIBLE TOP STORAGE

#### REMOVAL

- (1) Raise and secure convertible top.
- (2) Remove screws attaching headliner to top well.
- (3) Remove push in fasteners attaching convertible top storage section to rear of storage area (Fig. 5).
- (4) Remove push in fasteners attaching storage area below seat belt bezel.
- (5) Pull rear of storage area upward and disengage front of storage area from beauty bar.
- (6) Remove storage area from vehicle.



**Fig. 5 Center Convertible Top Storage**

- 1 - CONVERTIBLE TOP STORAGE
- 2 - REAR DECK PANEL
- 3 - TACK STRIP
- 4 - PUSH-IN FASTENER

#### INSTALLATION

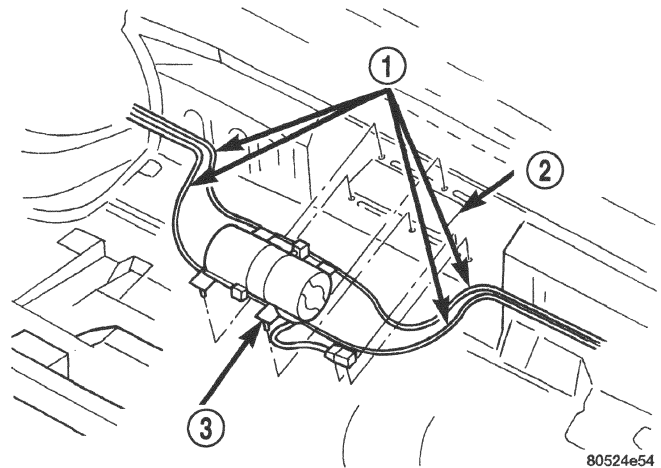
- (1) Position convertible top storage area in vehicle.
- (2) Engage front of storage area under beauty bar and push rear of storage area downward into position.
- (3) Install push in fasteners attaching convertible top storage section to rear of storage area.
- (4) Install push in fasteners to attach storage areas below seat belt bezel.
- (5) Install screws attaching headliner to top well.

### HYDRAULIC MOTOR/PUMP ASSEMBLY

#### REMOVAL

- (1) Disconnect battery negative cable.
- (2) Remove rear seat cushion and rear seat back.
- (3) Disconnect pump wire connector and ground connection (Fig. 6).
- (4) Disconnect hydraulic lines from pump.

- (5) Remove motor pump assembly from vehicle. The rubber mounts are pressed and locked into the mounting bracket. Pull up on motor assembly to remove.



**Fig. 6 Hydraulic Pump Assembly**

- 1 - HYDRAULIC LINES
- 2 - MOUNTING BRACKET
- 3 - HYDRAULIC PUMP ASSEMBLY

#### INSTALLATION

- (1) Position hydraulic motor in vehicle.
- (2) Press hydraulic motor into mounts.
- (3) Connect hydraulic lines to pump.
- (4) Connect pump wire connector and ground connection.
- (5) Connect battery negative cable.
- (6) Bleed the motor/pump and fill and verify operation of hydraulic pump.
- (7) Install rear seat cushion and rear seat back.

### HYDRAULIC CYLINDER

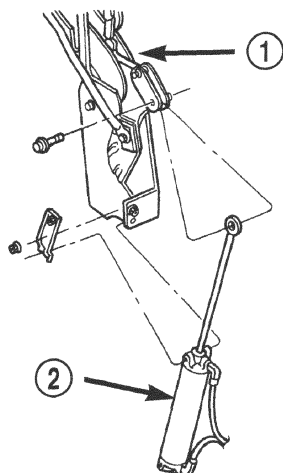
#### REMOVAL

- (1) Disconnect battery negative cable.
- (2) Remove rear seat cushion and rear seat back.
- (3) Remove quarter trim panel.
- (4) Remove cylinder mounting bracket and nut (Fig. 7).
- (5) Remove pivot bolt attaching cylinder shaft to top linkage.
- (6) Disconnect hydraulic lines from the cylinder.
- (7) Remove cylinder from vehicle.

#### INSTALLATION

- (1) Place cylinder into position.
- (2) Connect hydraulic lines to the cylinder.
- (3) Install pivot bolt attaching cylinder shaft to top linkage.
- (4) Install cylinder mounting bracket and nut.



**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 7 Hydraulic Cylinder**

- 1 - CONVERTIBLE TOP LOWER PIVOT  
2 - HYDRAULIC CYLINDER

- (5) Bleed the motor/pump and fill hydraulic system and check for proper operation.
- (6) Install quarter trim panel.
- (7) Install rear seat cushion and rear seat back.
- (8) Connect battery negative cable.

**HYDRAULIC LINES****REMOVAL**

- (1) Remove rear seat cushion and rear seat back.
- (2) Remove both quarter trim panels.
- (3) Disconnect hydraulic line from hydraulic cylinders.
- (4) Disconnect hydraulic line from hydraulic pump.
- (5) Remove hydraulic line from vehicle.

**INSTALLATION**

- (1) Position hydraulic line to vehicle.
- (2) Connect hydraulic line to hydraulic pump.
- (3) Connect hydraulic line to hydraulic cylinders.
- (4) Bleed the motor/pump and fill hydraulic system. Check for leaks and proper operation.
- (5) Install quarter trim panels.
- (6) Install rear seat cushion and rear seat back.

**ADJUSTMENTS****CONVERTIBLE TOP HYDRAULIC MOTOR/PUMP BLEEDING PROCEDURES**

Convertible top does not start to raise within 2 seconds after the switch is activated. Bleed the convertible top motor/pump assembly.

- (1) Lower the top to the full down position.
- (2) Remove the rear seat cushion, seat back and inner quarter trim panels.

(3) Remove the cylinder mounting brackets and remove the cylinders from the trunnion pivot mounts.

(4) Rotate the cylinders 180 degrees (the hose fittings will now face to front of the vehicle).

(5) Disconnect the motor/pump retaining clips from the body.

(6) Rotate and raise the motor/pump assembly so the reservoir is in the up position. The rubber filler plug will be at the top.

(7) Raise motor/pump fitting to at least 2 inches above the horizontal rear seat back reinforcement.

(8) Tilt the motor/pump assembly to approximately the 10 o'clock position, with the rubber filler plug still at the top.

**CAUTION: THE MOTOR/PUMP ASSEMBLY MUST REMAIN IN THE CURRENT POSITION UNTIL THE RUBBER FILLER PLUG IS REINSTALLED IN THE Step 12.**

(9) Remove the rubber fill plug from reservoir.

(10) Fill the hydraulic system by adding Dexron 2 Automatic Transmission Fluid to the bottom of the fill hole.

**CAUTION: DO NOT OPERATE THE TOP SWITCH IN THE UP (CLOSING THE TOP) DIRECTION.**

(11) With two people, activate the top switch in the down (opening the top) position to fully retract the cylinder rods and hold for approximately 5 seconds, until the motor/pump stalls. A percolating or gurgling sound/feeling is an indication that the procedure is working.

(12) Top off the motor/pump with Dexron 2 and insert the filler plug.

(13) Install the motor/pump assembly into the vehicle mounting bracket.

(14) Rotate the cylinders back to the original position (hose fitting rearward).

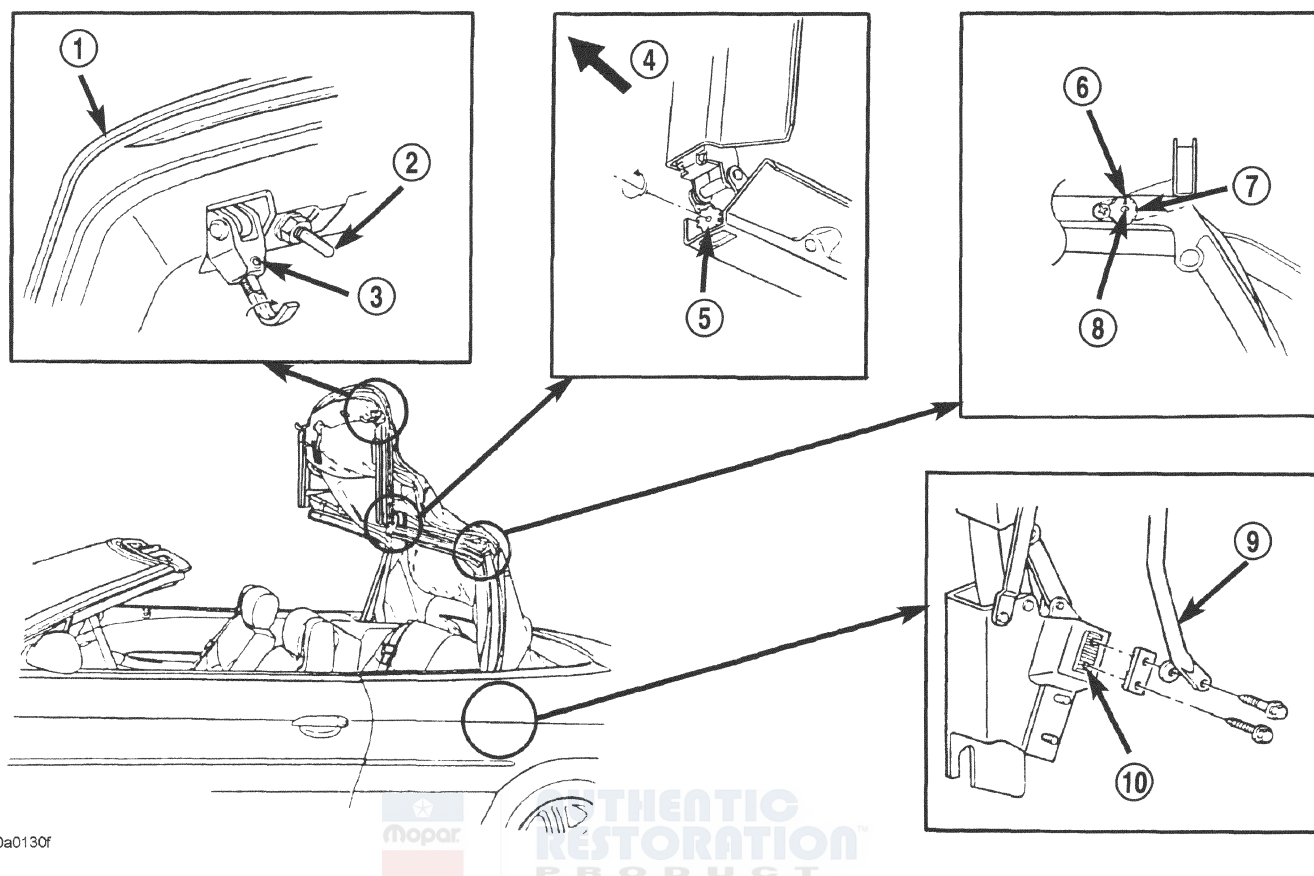
(15) Install the motor/pump lead and hydraulic line clips (the hydraulic line clips are to assist in the production process) to ensure that the seat back/seat cushion do not pinch the lines. If the sticky side is no longer holding to the floor pan, the clips can be left off.

(16) Ensure that the bushing is still on the trunnion pivot mount and bracket. Tap the top switch in (raising the top) to get the cylinder trunnion onto the trunnion pivot mounts, if needed.

(17) Install cylinder mounting brackets.

(18) Raise and lower the top to ensure proper operation.

(19) Install the inner quarter panels, and the rear seat back and cushion.

**ADJUSTMENTS (Continued)**

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**Fig. 8 Adjustment Locations**

- |   |   |
|---|---|
| 1 - TOP HEADER  | 7 - CAM   |
| 2 - DOWEL PIN   | 8 - TURN DART TOWARD FRONT (HEADER MOVES REARWARD AND UP) |
| 3 - SET SCREW   | 9 - BALANCE LINK  |
| 4 - FRONT   | 10 - SERRATED PLATE                                       |
| 5 - FRONT-TO-CENTER RAIL ADJUSTING SCREW                |   |
| 6 - TURN DART TOWARD REAR (HEADER MOVES FORWARD AND UP) |   |

**CONVERTIBLE TOP ADJUSTMENTS**

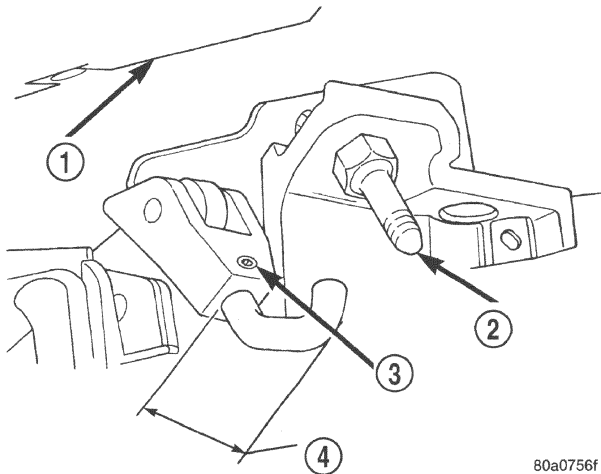
Refer to (Fig. 8) to determine which adjustment is required. Refer to the appropriate procedure for more information.

## ADJUSTMENTS (Continued)

### DOWEL PIN ADJUSTMENTS

- (1) Loosen dowel pins (Fig. 9).
- (2) Position dowel pins to the center of the receiver holes in the windshield header.
- (3) Tighten dowel pins and verify adjustment.

**NOTE:** Refer to Cam Adjustment or Balance Link Adjustment paragraphs of this section to adjust forward or rearward position of the top header.



**Fig. 9 Roof Latch and Guide Dowel Pin**

- 1 - HEADER
- 2 - DOWEL PIN
- 3 - SET SCREW
- 4 - 25.4 mm MIN  
35.56 mm MAX

### LATCH HOOK ADJUSTMENT

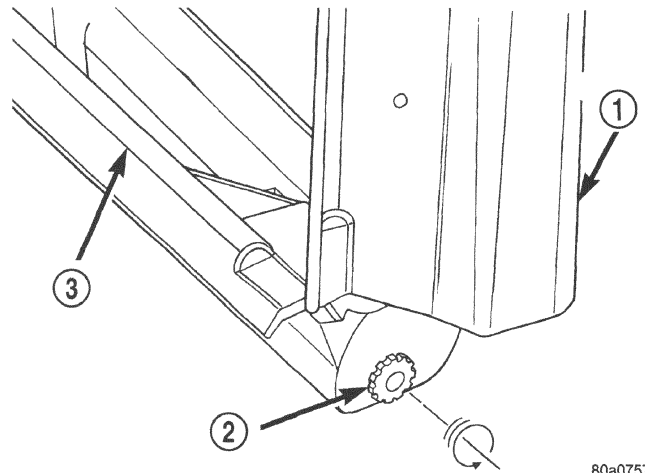
If the convertible top latching effort is excessive, it can be reduced by lengthening the latch hook (Fig. 9). The top header weatherstrip requires enough compression to prevent air and water leaks. Adjust latch hook to achieve reasonable latching effort and proper sealing.

### FRONT TO CENTER RAIL ADJUSTMENT

To align the roof rail weatherstrips to the door and quarter glass contact, adjust the front to center rail adjusting screw (Fig. 10). To decrease pressure on door glass turn adjuster inward. To increase pressure on door glass turn adjuster outward.

### TOP FRAME CAM ADJUSTMENT

The top frame cam changes forward or rearward position of the top header in relation to the windshield header. The cam turns inside the rear side rail and thrust link (Fig. 11). It may be necessary to lengthen the balance links 1 or 2 serrations after a cam adjustment. The position of the cam high side determines the angle between the center and rear side rails. When the high side is fully forward, the

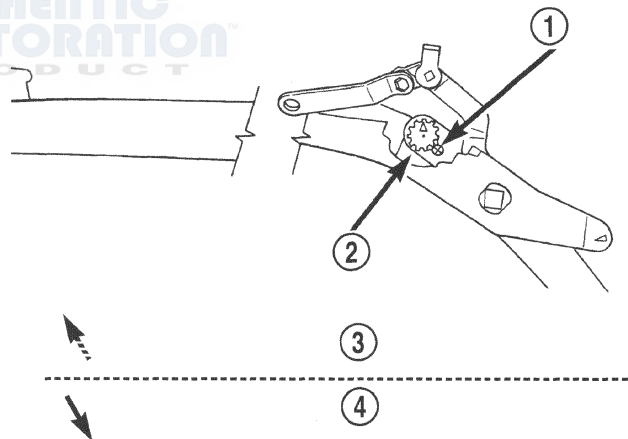


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**Fig. 10 Roof Rail Adjustment**

- 1 - FRONT RAIL
- 2 - FRONT TO CENTER RAIL ADJUSTING SCREW
- 3 - CENTER RAIL

angle is at a minimum, and when turned rearward, the angle is increased. An increased angle increases the forward movement of the top. The cam high side is indicated by a arrow on the cam threaded end.



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**Fig. 11 Cam Assembly**

- 1 - TORX SCREW
- 2 - CAM
- 3 - TURN DART TOWARDS REAR OF CAR  
HEADER MOVES IN THIS DIRECTION
- 4 - TURN DART TOWARDS FRONT OF CAR  
HEADER MOVES IN THIS DIRECTION

### TO ADJUST CAM SETTING

- (1) Lower top to half down position to remove all possible strain from the cam.
- (2) Remove torx head screw.
- (3) Using appropriate torx bit, rotate cam as necessary and secure set screw.

**ADJUSTMENTS (Continued)****BALANCE LINK ADJUSTMENT**

**WARNING: DO NOT PLACE HANDS OVER GAPS IN MOVABLE CONVERTIBLE TOP COMPONENTS DURING SERVICING. PERSONAL INJURY CAN RESULT.**

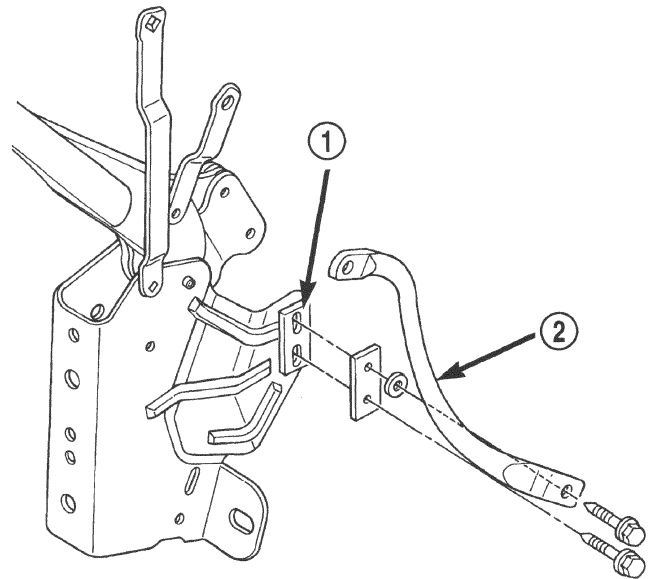
(1) Remove convertible top head lining as necessary to gain access to adjusters.

(2) With the top latched in up position, loosen both bolts just enough to permit moving link up or down (Fig. 12).

(3) Push upward in the area of the front to center rail joint. Push rails up by hand as far as possible.

(4) With the balance link adjusting bolts loosened, allow the balance link to seek proper position.

(5) Tighten bolts while rail is held in position.



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**Fig. 12 Balance Link Adjustment**

1 - SERRATED PLATE

2 - BALANCE LINK



**AUTHORIZED  
RESTORATION  
PRO**

**SPECIFICATIONS****TORQUE SPECIFICATIONS****DESCRIPTION****TORQUE****Convertible Top**

Header Latch Mounting Screw . . . . 5 to 7.3 N·m  
(45 to 65 in. lbs.)

Seal Retainer Mounting Screw . . . . 2.8 to 4 N·m  
(25 to 35 in. lbs.)

**Number 4 bow**

Retainer Mounting Screw . . . . . 1.1 to 2.3 N·m  
(10 to 20 in. lbs.)



## BODY COMPONENTS

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## DESCRIPTION AND OPERATION

### VEHICLE IDENTIFICATION

#### DESCRIPTION

Throughout this group, references to the DaimlerChrysler Corporation vehicle family identification code are used when describing a procedure that is unique to that vehicle. Refer to Introduction Group of this manual for detailed information on vehicle identification. If a procedure is common to all vehicles covered in this manual, no reference will be made to a vehicle family code.

### SAFETY PRECAUTIONS AND WARNINGS

#### DESCRIPTION

**WARNING: USE A OSHA APPROVED BREATHING FILTER WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.**

**AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL - BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.**

**DO NOT STAND UNDER A HOISTED VEHICLE THAT IS NOT PROPERLY SUPPORTED ON SAFETY STANDS. PERSONAL INJURY CAN RESULT.**

**CAUTION:** When holes must be drilled or punched in an inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle can result.

Do not weld exterior panels unless combustible material on the interior of vehicle is removed from the repair area. Fire or hazardous conditions, can result.

Always have a fire extinguisher ready for use when welding.

Disconnect the negative (-) cable clamp from the battery when servicing electrical components that are live when the ignition is OFF. Damage to electrical system can result.

Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.

Do not use harsh alkaline based cleaning solvents on painted or upholstered surfaces. Damage to finish or color can result.

Do not hammer or pound on plastic trim panel when servicing interior trim. Plastic panels can break.

DaimlerChrysler Corporation uses many different types of push-in fasteners to secure the interior and exterior trim to the body. Most of these fasteners can be reused to assemble the trim during various repair

procedures. At times, a push-in fastener cannot be removed without damaging the fastener or the component it is holding. If it is not possible to remove a fastener without damaging a component or body, cut or break the fastener and use a new one when installing the component. Never pry or pound on a plastic or pressed-board trim component. Using a suitable fork-type prying device, pry the fastener from the retaining hole behind the component being removed. When installing, verify fastener alignment with the retaining hole by hand. Push directly on or over the fastener until it seats. Apply a low-force pull to the panel to verify that it is secure.

When it is necessary to remove components to service another, it should not be necessary to apply excessive force or bend a component to remove it. Before damaging a trim component, verify hidden fasteners or captured edges holding the component in place.

## DIAGNOSIS AND TESTING

### WATER LEAKS

Water leaks can be caused by poor sealing, improper body component alignment, body seam porosity, missing plugs, or blocked drain holes. Centrifugal and gravitational force can cause water to drip from a location away from the actual leak point, making leak detection difficult. All body sealing points should be water tight in normal wet-driving conditions. Water flowing downward from the front of the vehicle should not enter the passenger or luggage compartment. Moving sealing surfaces will not always seal water tight under all conditions. At times, side glass or door seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Overcompensating on door or glass adjustments to stop a water leak that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After completing a repair, water test vehicle to verify leak has stopped before returning vehicle to use.

### VISUAL INSPECTION BEFORE WATER LEAK TESTS

Verify that floor and body plugs are in place, body drains are clear, and body components are properly aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

### WATER LEAK TESTS

**WARNING: DO NOT USE ELECTRIC SHOP LIGHTS OR TOOLS IN WATER TEST AREA. PERSONAL INJURY CAN RESULT.**



## DIAGNOSIS AND TESTING (Continued)

When the conditions causing a water leak have been determined, simulate the conditions as closely as possible.

- If a leak occurs with the vehicle parked in a steady light rain, flood the leak area with an open-ended garden hose.
- If a leak occurs while driving at highway speeds in a steady rain, test the leak area with a reasonable velocity stream or fan spray of water. Direct the spray in a direction comparable to actual conditions.
- If a leak occurs when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition. This method can be used when the leak occurs when the vehicle accelerates, stops or turns. If the leak occurs on acceleration, hoist the front of the vehicle. If the leak occurs when braking, hoist the back of the vehicle. If the leak occurs on left turns, hoist the left side of the vehicle. If the leak occurs on right turns, hoist the right side of the vehicle. For hoisting recommendations refer to Group 0, Lubrication and Maintenance, General Information section.

### WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the leak area. If the hose cannot be positioned without being held, have someone help do the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

### MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

### BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage com-

partment. If light is visible through a normally sealed location, water could enter through the opening.

### PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

### WIND NOISE

Wind noise is the result of most air leaks. Air leaks can be caused by poor sealing, improper body component alignment, body seam porosity, or missing plugs in the engine compartment or door hinge pillar areas. All body sealing points should be airtight in normal driving conditions. Moving sealing surfaces will not always seal airtight under all conditions. At times, side glass or door seals will allow wind noise to be noticed in the passenger compartment during high cross winds. Over compensating on door or glass adjustments to stop wind noise that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, test vehicle to verify noise has stopped before returning vehicle to use.

Wind noise can also be caused by improperly fitted exterior moldings or body ornamentation. Loose moldings can flutter, creating a buzzing or chattering noise. An open cavity or protruding edge can create a whistling or howling noise. Inspect the exterior of the vehicle to verify that these conditions do not exist.

### VISUAL INSPECTION BEFORE TESTS

Verify that floor and body plugs are in place and body components are aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

### ROAD TESTING WIND NOISE

(1) Drive the vehicle to verify the general location of the wind noise.

(2) Apply 50 mm (2 in.) masking tape in 150 mm (6 in.) lengths along weatherstrips, weld seams or moldings. After each length is applied, drive the vehicle. If noise goes away after a piece of tape is applied, remove tape, locate, and repair defect.

## DIAGNOSIS AND TESTING (Continued)

### POSSIBLE CAUSE OF WIND NOISE

- Moldings standing away from body surface can catch wind and whistle.
- Gaps in sealed areas behind overhanging body flanges can cause wind-rushing sounds.
- Misaligned movable components.
- Missing or improperly installed plugs in pillars.
- Weld burn through holes.

## SERVICE PROCEDURES

### HEAT STAKING

- (1) Remove trim panel.
- (2) Bend or move the trim panel components at the heat staked joints. Observe the heat staked locations and/or component seams for looseness.
- (3) Heat stake the components.
  - (a) If the heat staked or component seam location is loose, hold the two components tightly together and using a soldering gun with a flat tip, melt the material securing the components together. Do not over heat the affected area, damage to the exterior of the trim panel may occur.
  - (b) If the heat staked material is broken or missing, use a hot glue gun to apply new material to the area to be repaired. The panels that are being heat staked must be held together while the applying the glue. Once the new material is in place, it may be necessary to use a soldering gun to melt the newly applied material. Do not over heat the affected area, damage to the exterior of the trim panel may occur.
- (4) Allow the repaired area to cool and verify the repair.
- (5) Install trim panel.

## PLASTIC BODY PANEL REPAIR

### DESCRIPTION OPERATION

Resin Transfer Molded (RTM) body panels are reinforced with a continuous fiberglass mesh. Epoxy resin is injected into a gel-coated and fiberglass lined mold to form a body panel. Sheet molded compound (SMC) body panels are constructed with fiberglass strands usually 1 inch or shorter, epoxy resin formed into sheet stock and pressed in mold flowing material to form a sheet molded compound (SMC) body panel. RTM and SMC body panels can be repaired with epoxy adhesive after market products. Refer to instructions provided by the manufacturer of products being used to repair RTM or SMC. Daimler-Chrysler Corporation recommends that a trained automotive body technician perform body panel repair procedures (Fig. 1).

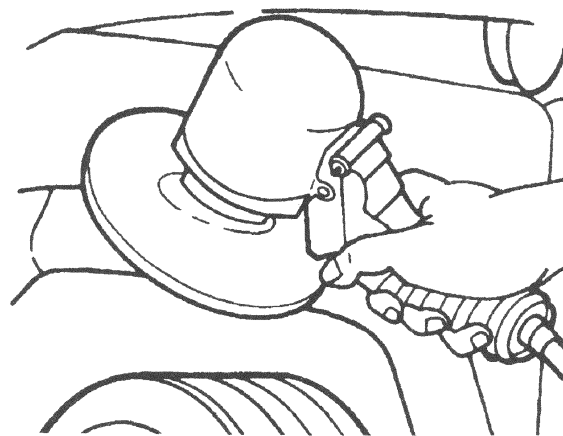


Fig. 1 Panel Repair

### SAFETY PRECAUTION AND WARNINGS

**WARNING: EYE PROTECTION SHOULD BE USED WHEN SERVICING RTM AND SMC COMPONENTS. PERSONAL INJURY CAN RESULT.**

**USE AN OSHA APPROVED BREATHING DEVICE WHEN MIXING EPOXY, GRINDING RTM AND SMC, AND SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.**

**AVOID PROLONGED SKIN CONTACT WITH EPOXY RESIN, PETROLEUM, OR ALCOHOL BASED SOLVENTS. PERSONAL INJURY CAN RESULT.**

**DO NOT VENTURE UNDER A HOISTED VEHICLE THAT IS NOT PROPERLY SUPPORTED ON SAFETY STANDS. PERSONAL INJURY CAN RESULT.**

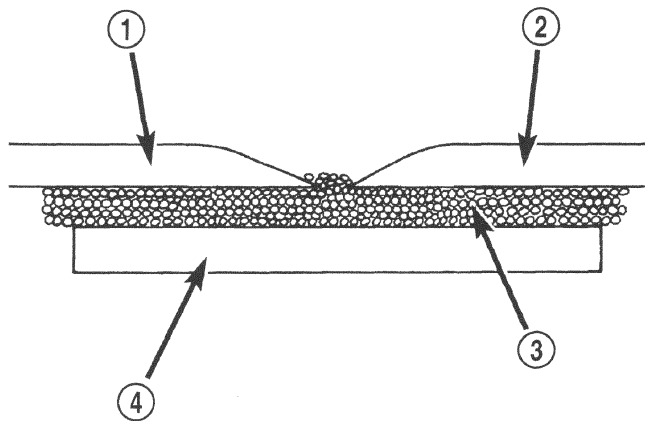
- When holes must be drilled or cut in body panels, verify locations of internal body components and electrical wiring. Damage to vehicle can result.
- Do not use abrasive chemicals or compounds on undamaged painted surfaces around repair areas. Damage to finish can result.

### PANEL SECTIONING

If it is required to section a large panel for an SMC or RTM repair, it will be necessary to reinforce the panel with epoxy structural adhesive (rigid repair adhesive) (Fig. 2). To bond two plastic panels together, a reinforcement must overlap both panels. The panels must be "V'd" at a 20 degree angle. The area to be reinforced should be washed, then sanded. Be sure to wipe off any excess soap and water when finished. Lightly sand or abrade the plastic with an abrasive pad or sandpaper. Blow off any dust with compressed air or wipe with a clean dry rag.

When bonding SMC or RTM panels, use a two-part epoxy adhesive. Properly mix parts A and B, and apply it to the panels being repaired. Be sure that enough adhesive has been applied to allow squeeze out and to fill the full bond line. Once the pieces



**SERVICE PROCEDURES (Continued)**

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**Fig. 2 Panel Sectioning**

- 1 - EXISTING PANEL
- 2 - NEW PANEL
- 3 - PANEL ADHESIVE
- 4 - BONDING STRIP

have been brought together, do not move them until the adhesive is cured. The assembly can be held together with clamps, rivets, etc. A faster cure can be obtained by heating with a heat lamp or heat gun.

After the parts have been bonded and have had time to cure, rough sand the seam and apply the final adhesive filler to the area being repaired. Smooth the filler with a spatula, wooden tongue depressor, or squeegee. For fine texturing, a small amount of water can be applied to the filler surface while smoothing. The cured filler can be sanded as necessary and, as a final step, cleanup can be done with soapy water. Wipe the surface clean with a dry cloth allowing time for the panel to dry before moving on with the repair.

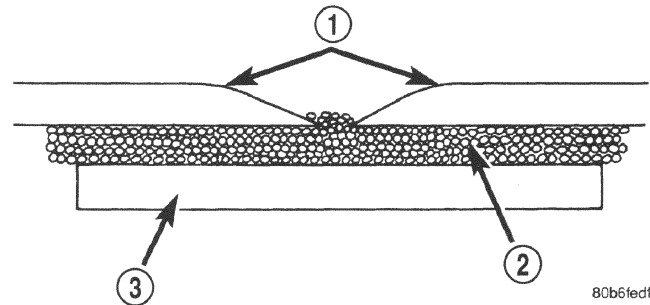
**PANEL REINFORCEMENT**

Structural repair procedures for rigid panels such as Sheet Molding Compound (SMC) or Resin Transfer Molding (RTM) with large cracks and holes will require a reinforcement backing. Reinforcements can be made with several applications of glass cloth saturated with epoxy structural adhesive, semirigid or flexible repair materials should be used for semirigid or flexible part repairs (Fig. 3) and (Fig. 4). Open meshed fiberglass dry wall tape can be used to form a reinforcement. The dry wall tape allows the resin to penetrate through and make a good bond between the panel and the epoxy adhesive. Structurally, the more dry wall tape used, the stronger the repair.

Another kind of repair that can be done to repair large cracks and holes is to use a scrap piece of similar plastic and bond with structural adhesive. The reinforcement should cover the entire break and

should have a generous amount of overlap on either side of the cracked or broken area.

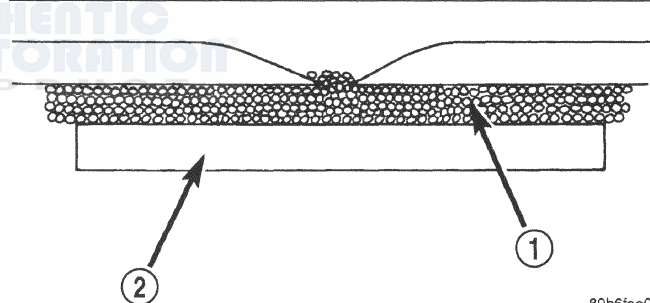
When repairing plastic, the damaged area is first "V'd" out, or beveled. Large bonding areas are desirable when repairing plastic because small repairs are less likely to hold permanently. Beveling the area around a crack at a 20 degree angle will increase the bonding surface for a repair (Fig. 5). It is recommended that sharp edges be avoided because the joint may show through after the panel is refinished.



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**Fig. 3 Softened Edges**

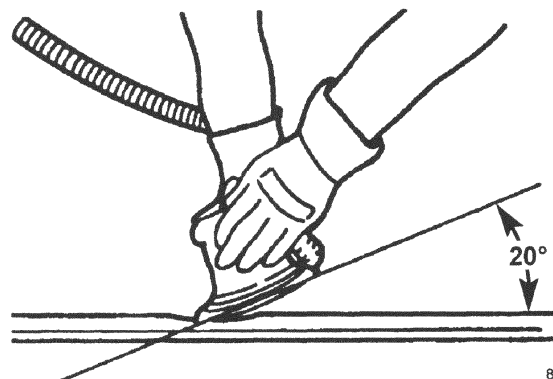
- 1 - SOFTENED EDGES
- 2 - PANEL ADHESIVE
- 3 - BONDING STRIP



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**Fig. 4 Panel Reinforcement**

- 1 - PANEL ADHESIVE
- 2 - REINFORCEMENT



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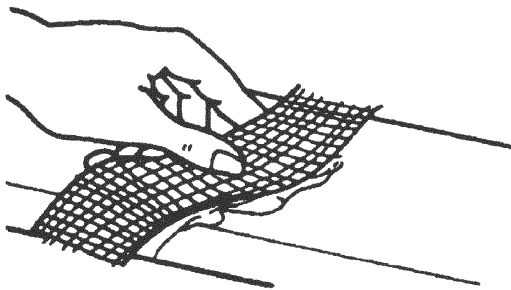
**Fig. 5 Beveling Angle - 20 Degree**

## SERVICE PROCEDURES (Continued)

- Panel repair for both flexible and rigid panels are basically the same. The primary difference between flexible panel repair and rigid panel repair is in the adhesive materials used (Fig. 6).

- The technician should first decide what needs to be done when working on any type of body panel. One should determine if it is possible to return the damage part to its original strength and appearance without exceeding the value of the replacement part.

- When plastic repairs are required, it is recommended that the part be left on the vehicle when every possible. That will save time, and the panel will remain stationary during the repair. Misalignment can cause stress in the repair areas and can result in future failure.



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**Fig. 6 Fiberglass Tape**

## VISUAL INSPECTION

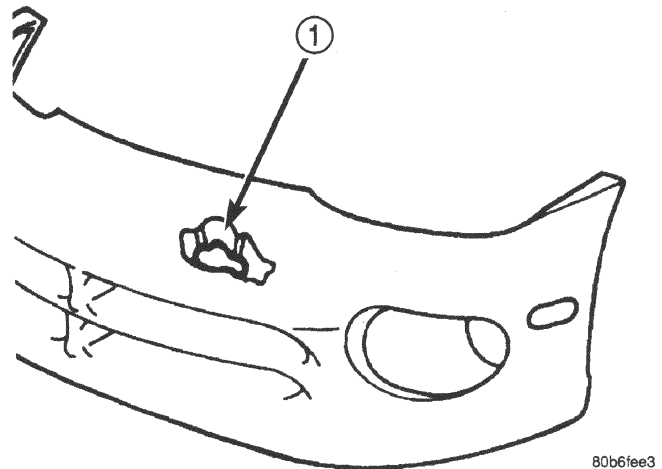
Sheet Molding Compound (SMC) and Resin Transfer Molding (RTM), because they are composites, react differently to impact that sheet metal does. Composite materials can mask the severity of an accident. Adhesive bond lines, interior structure of the doors, and steel structure need to be inspected carefully to get a true damage assessment. Close inspection may require partial removal of interior trim or inner panels.

Identify the type of repair:

**Puncture or Crack** – Damage that has penetrated completely through the panel. Damage is confined to one general area; a panel section is not required. However, a backer panel, open fiberglass tape, or matted material must be bonded from behind (Fig. 7).

## PANEL SURFACE PREPARATION

If a body panel has been punctured, cracked, or crushed, the damaged area must be removed from the panel to achieve a successful repair. All spider web cracks leading away from a damaged area must be stopped or removed. To stop a running crack in a SMC or RTM panel, drill a 6 mm (0.250 in.) hole at the end of the crack farthest away from the damage. If spider web cracks can not be stopped, the panel would require replacement. The surfaces around the damaged area should be stripped of paint and freed from wax and oil. Scuff surfaces around repair area



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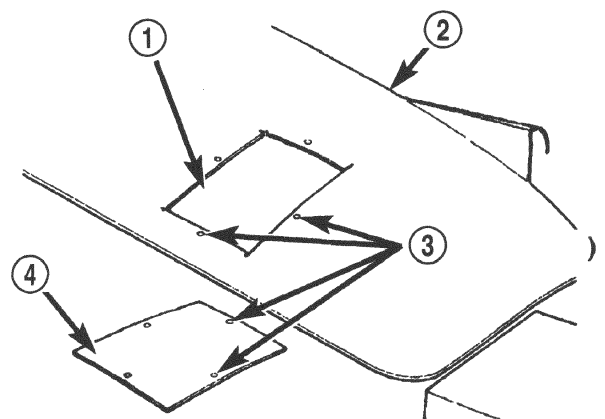
**Fig. 7 Damage Component**

1 – PUNCTURE

with 360 grit wet/dry sand paper, or equivalent, to assure adhesion of epoxy repair materials.

## PATCHING PANELS

An RTM or SMC panel that has extensive puncture type damage can be repaired by cutting out the damaged material (Fig. 8). Use a suitable reciprocating saw or cut off wheel to remove the section of the SMC or RTM panel that is damaged. The piece cut out can be used as a template to shape the new patch. It is not necessary to have access to the back of the panel to install a patch. Bevel edges of cutout at 20 degrees to expose a larger bonding area on the outer side. This will allow for an increased reinforcement areas.



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**Fig. 8 Damaged Panel Cutout and Patch**

- 1 – CUTOUT
- 2 – DAMAGED BODY PANEL
- 3 – 4MM (0.160 IN.) HOLES
- 4 – PATCH CUT TO SIZE

## SERVICE PROCEDURES (Continued)

### PANEL PATCH FABRICATIONS

A patch can be fabricated from any rigid fiberglass panel that has comparable contour with the repair area. discard SMC or RTM panels. Lift gates and fenders can be used to supply patch material. If existing material is not available or compatible, a patch can be constructed with epoxy and reinforcement mesh (dry wall tape). Perform the following operation if required:

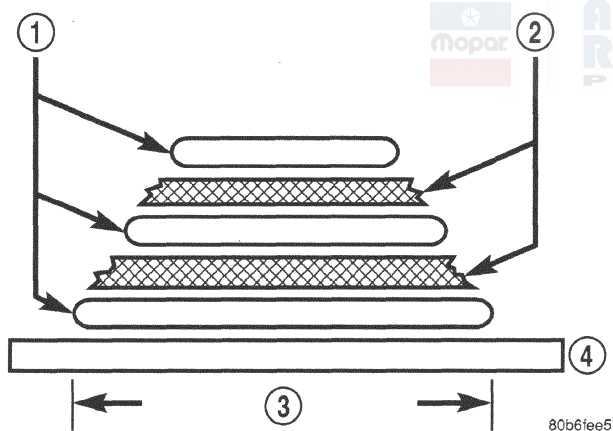
(1) Cover waxed paper or plastic with adhesive backed nylon mesh (dry wall tape) larger than the patch required (Fig. 9).

(2) Tape waxed paper or plastic sheet with mesh to a surface that has a compatible contour to the repair area.

(3) Apply a liberal coat of epoxy adhesive over the reinforcement mesh (Fig. 9). If necessary apply a second or third coat of epoxy and mesh after first coat has cured. The thickness of the patch should be the same as the repair area.

(4) After patch has cured, peel waxed paper or plastic from the back of the patch.

(5) If desired, a thin film coat of epoxy can be applied to the back of the patch to cover mesh for added strength.



**Fig. 9 Fabricated Panel**

- 1 - STRUCTURAL ADHESIVE OR EPOXY RESIN
- 2 - FIBERGLASS CLOTH OR FIBERGLASS MESH TAPE
- 3 - WIDTH OF V-GROOVE
- 4 - WAXED PAPER

### PANEL PATCH INSTALLATION

(1) Make a paper or cardboard pattern the size and shape of the cutout hole in the panel.

(2) Trim 3 mm (0.125 in.) from edges of pattern so patch will have a gap between connecting surfaces.

(3) Using the pattern as a guide, cut the patch to size.

(4) Cut scrap pieces of patch material into 50 mm (2 in.) squares to use as patch supports to sustain the patch in the cutout.

(5) Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) in from edge of cutout hole (Fig. 8).

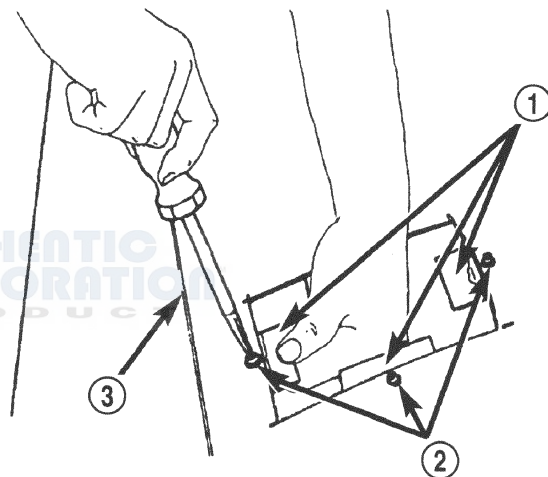
(6) Drill 3 mm (0.125 in.) holes in the support squares 13 mm (0.5 in.) from the edge in the center of one side.

(7) Scuff the backside of the body panel around the cutout hole with a scuff pad or sandpaper.

(8) Mix enough epoxy to cover one side of all support squares.

(9) Apply epoxy to the support squares on the half with the hole pre-drilled in it.

(10) Using number 8 sheet metal screws, secure support squares to back side of body panel with epoxy sandwiched between the panel and squares (Fig. 10).



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**Fig. 10 Secure Support Squares To Body Panel**

- 1 - SUPPORT SQUARES
- 2 - SCREWS
- 3 - DAMAGED BODY PANEL



## SERVICE PROCEDURES (Continued)

(11) Position patch in cutout against support squares and adjust patch until the gap is equal along all sides (Fig. 11).

(12) Drill 3 mm (0.125 in.) holes in the support squares through the pre-drilled holes in the patch.

(13) Apply a coat of epoxy to the exposed ends of the support squares (Fig. 12).

(14) Install screws to hold the patch to support squares (Fig. 13). Tighten screws until patch surface is flush with panel surface.

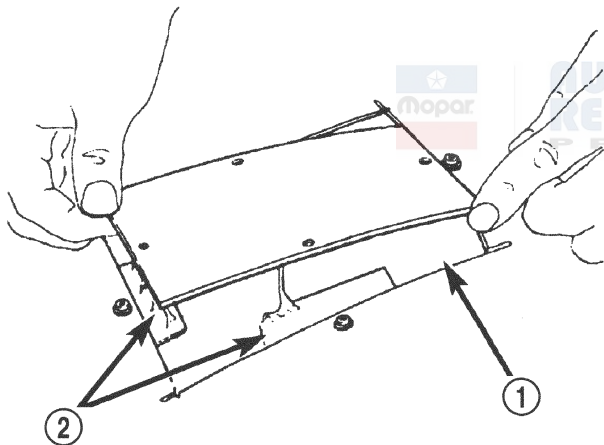
(15) Allow epoxy to cure, and remove all screws.

(16) Using a 125 mm (5 in.) 24 grit disc grinder, grind a 50 mm (2 in.) to 75 mm (3 in.) wide and 2 mm (0.080 in.) deep path across the gaps around the patch (Fig. 14). With compressed air, blow dust from around patch.

(17) Apply adhesive backed nylon mesh (dry wall tape) over gaps around patch (Fig. 15).

(18) Mix enough epoxy to cover the entire patch area.

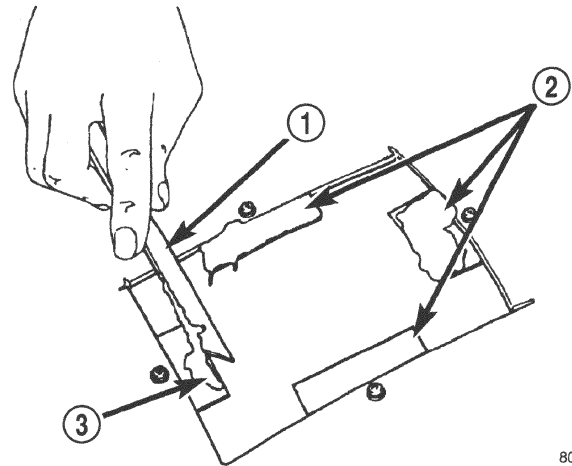
(19) Apply epoxy over the mesh around patch, and smooth epoxy with a wide spreader to reduce finish grinding. Use two to three layers of mesh and epoxy to create a stronger repair (Fig. 16).



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**Fig. 11 Position Patch In Cutout And Align**

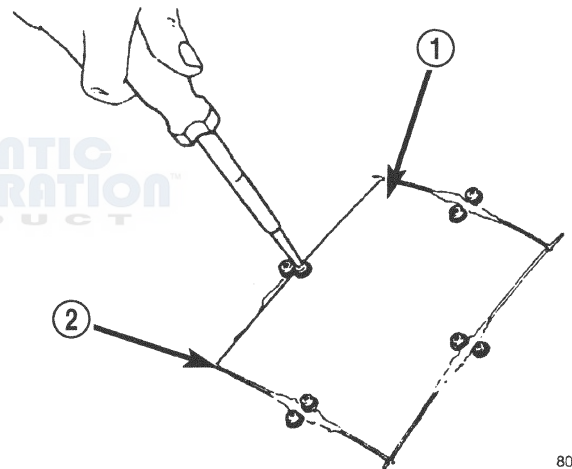
- 1 - CUTOUT
- 2 - SUPPORT SQUARES



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**Fig. 12 Apply Epoxy To Support Squares**

- 1 - APPLICATOR
- 2 - SUPPORT SQUARES
- 3 - EPOXY

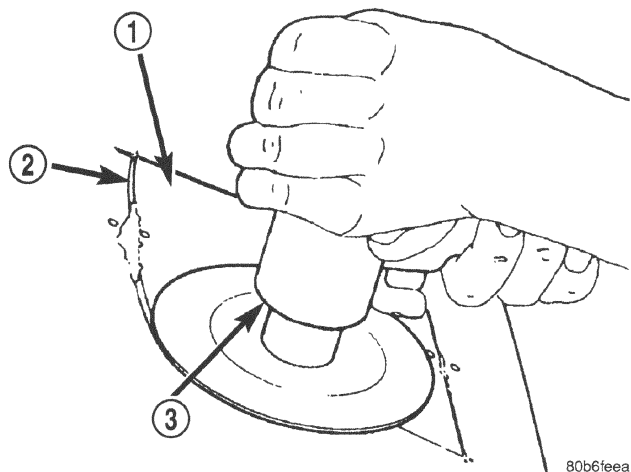


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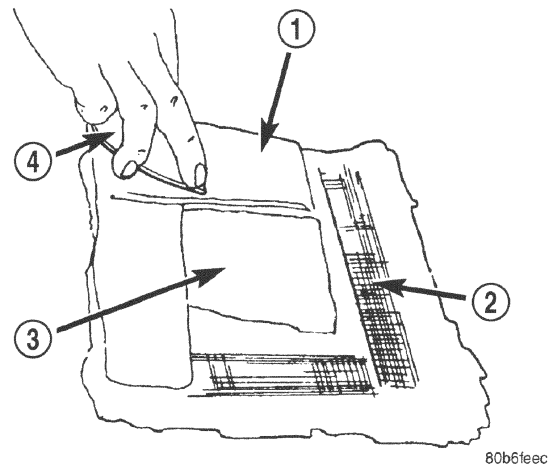
**Fig. 13 Install Screws**

- 1 - PATCH
- 2 - GAP

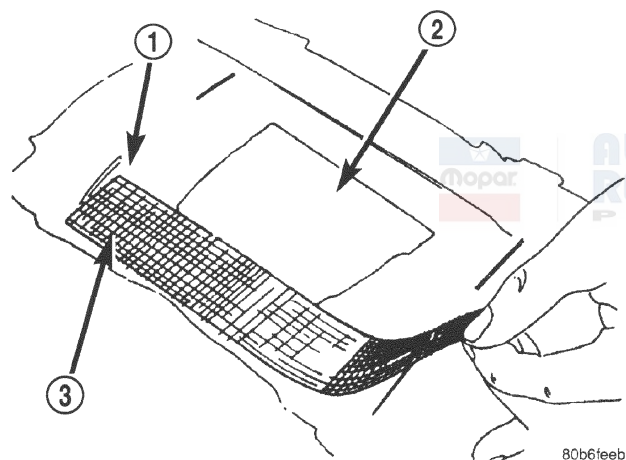


**SERVICE PROCEDURES (Continued)****Fig. 14 Grind Surface**

- 1 - PATCH
- 2 - GAP
- 3 - DISC GRINDER

**Fig. 16 Cover Mesh With Epoxy**

- 1 - EPOXY
- 2 - MESH
- 3 - PATCH
- 4 - SPREADER

**Fig. 15 Cover Gaps With Mesh**

- 1 - GROUND DOWN AREA
- 2 - PATCH
- 3 - MESH

**PATCHED PANEL SURFACING**

After patch panel is installed, the patch area can be finished using the same methods as finishing other types of body panels. If mesh material is exposed in the patched area, grind surface down, and apply a coat of high quality rigid plastic body filler. Prime, block sand, and paint as required.

## REMOVAL AND INSTALLATION

### RADIATOR SUPPORT CROSSMEMBER

#### REMOVAL

- (1) Release hood latch and open hood.
- (2) Remove push-in fasteners attaching fascia/grille to radiator support crossmember.
- (3) Remove bolts attaching support braces to bottom of radiator support crossmember.
- (4) Remove bolts attaching crossmember to radiator closure panel.
- (5) Remove nuts attaching hood latch to radiator support crossmember.
- (6) Remove radiator support crossmember from vehicle.

#### INSTALLATION

- (1) Place radiator support crossmember into position.
- (2) Install nuts attaching hood latch to radiator support crossmember.
- (3) Install bolts attaching crossmember to radiator closure panel.
- (4) Install bolts attaching support braces to bottom of radiator support crossmember.
- (5) Install push-in fasteners attaching fascia/grille to radiator support crossmember.
- (6) Close hood.

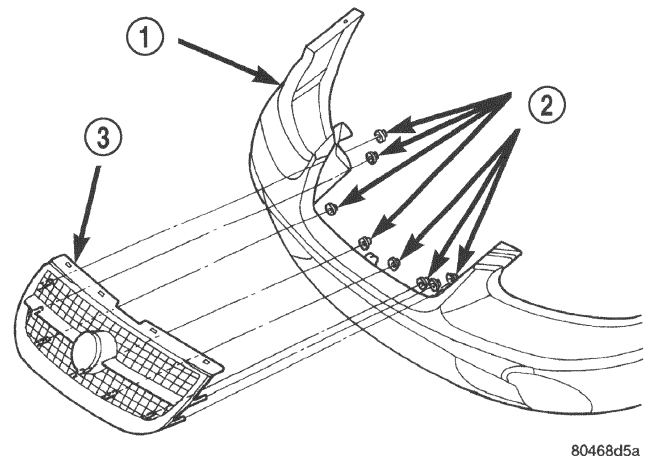
### GRILLE

#### REMOVAL

- (1) Release hood latch and open hood.
- (2) Raise vehicle on hoist.
- (3) Remove front tires.
- (4) Disconnect fog lamps, if equipped.
- (5) Remove side fascia attaching nuts, both sides.
- (6) Remove lower fascia retainers.
- (7) Remove upper fascia attaching bolts.
- (8) Remove side fascia attaching nuts, both sides.
- (9) Remove fascia from the vehicle.
- (10) Separate foam impact bar from fascia.
- (11) Remove clips attaching grille (Fig. 17).
- (12) Remove grille from fascia.
- (13) Transfer medallion.

#### INSTALLATION

- (1) Position grille on fascia.
- (2) Install clips attaching grille to fascia.
- (3) Install foam impact bar to fascia.
- (4) Place fascia into position.
- (5) Install side fascia attaching nuts, both sides.
- (6) Install upper fascia attaching bolts.
- (7) Install lower fascia retainers.
- (8) Install side fascia attaching nuts, both sides.



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**Fig. 17 Grille**

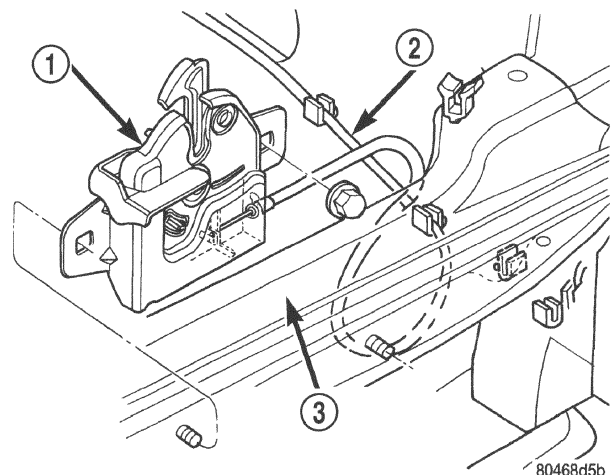
- 1 - FASCIA
- 2 - PUSH NUTS
- 3 - GRILLE

- (9) Connect fog lamps, if equipped.
- (10) Install front tires.
- (11) Lower vehicle.
- (12) Close hood.

### HOOD LATCH

#### REMOVAL

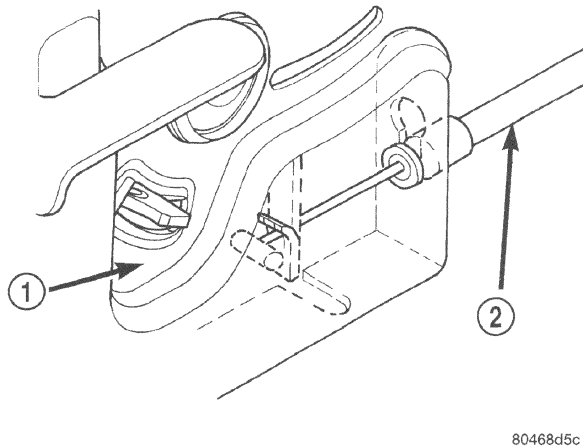
- (1) Release hood latch and open hood.
- (2) Support hood on prop rod.
- (3) Remove nuts attaching hood latch to upper radiator support crossmember (Fig. 18).
- (4) Remove hood latch from vehicle.
- (5) Disengage remote release cable from hood latch (Fig. 19).



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**Fig. 18 Hood Latch**

- 1 - HOOD LATCH
- 2 - HOOD RELEASE CABLE
- 3 - RADIATOR SUPPORT CROSSMEMBER

**REMOVAL AND INSTALLATION (Continued)****Fig. 19 Hood Latch Release Cable**

- 1 - HOOD LATCH  
2 - HOOD RELEASE CABLE

**INSTALLATION**

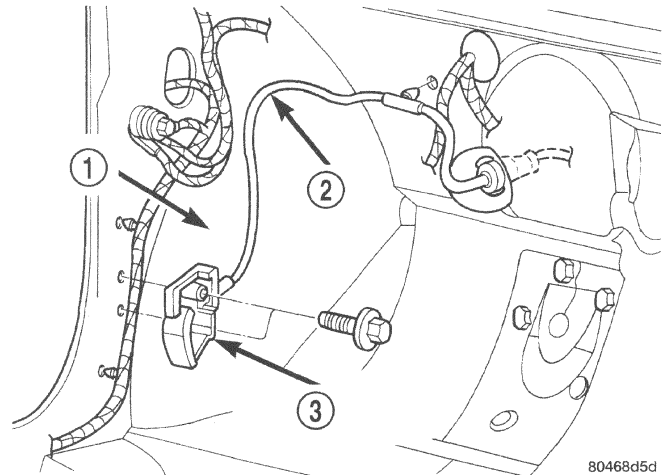
- (1) Engage remote release cable into hood latch (Fig. 19).
- (2) Position hood latch on vehicle.
- (3) Install nuts attaching hood latch onto upper radiator support crossmember.
- (4) Verify operation. Adjust as necessary.

**HOOD LATCH RELEASE CABLE****REMOVAL**

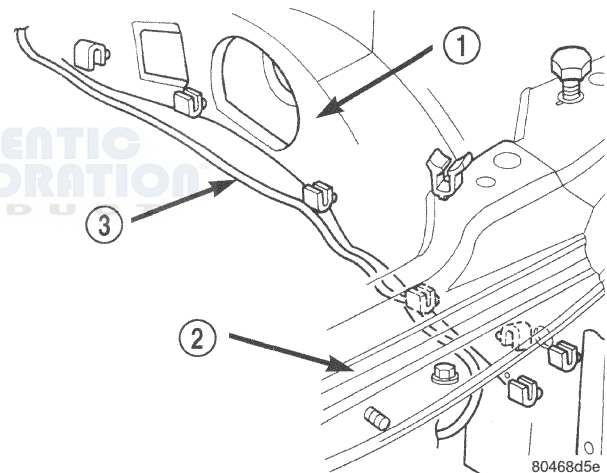
- (1) Remove hood latch.
- (2) Remove left front cowl trim panel.
- (3) Remove screws attaching hood release handle to inner cowl panel (Fig. 20).
- (4) Release clips attaching hood release cable to left inner frame rail (Fig. 21).
- (5) Disengage rubber grommet at lower dash panel.
- (6) Disengage push-in fastener attaching hood release cable to dash panel.
- (7) Remove hood release cable from vehicle.

**INSTALLATION**

- (1) Route hood release cable through hole in lower dash panel and along inner frame rail.
- (2) Engage rubber grommet to lower dash panel.
- (3) Engage push-in fastener attaching hood release cable to lower dash panel.
- (4) Install screws attaching hood release cable handle to inner cowl panel.
- (5) Install left front cowl trim panel.
- (6) Engage hood release cable into clips along inner frame rail (Fig. 21).
- (7) Install hood latch.

**Fig. 20 Hood Release Cable Handle**

- 1 - COWL PANEL  
2 - HOOD RELEASE CABLE  
3 - HOOD RELEASE HANDLE

**Fig. 21 Hood Release Cable Routing**

- 1 - FRAME RAIL  
2 - UPPER RADIATOR SUPPORT CROSSMEMBER  
3 - HOOD RELEASE CABLE

**HOOD****REMOVAL**

- (1) Open hood.
- (2) Disconnect under hood lamp wire connector from engine compartment wire harness, if equipped.
- (3) Mark outline of hinges on inside of hood to aid installation.
- (4) Remove the top bolts attaching hood to hinge and loosen the bottom bolts until they can be removed by hand.
- (5) With assistance from a helper at the opposite side of the vehicle to support the hood, remove bottom bolts attaching hood to hinge.

## REMOVAL AND INSTALLATION (Continued)

- (6) Remove the hood from the vehicle.

### INSTALLATION

- (1) With assistance from a helper, place hood in position on vehicle.
- (2) Install bottom bolts to attach hood to hinge finger tight.
- (3) Install top bolts to attach hood to hinge finger tight.
- (4) Position bolts at outline marks and tighten bolts. The hood should be aligned to 4 mm (0.160 in.) gap to the front fenders and flush across the top surfaces along fenders.
- (5) Connect under hood lamp wire connector to engine compartment wire harness, if equipped.
- (6) Verify hood latch operation and alignment. Adjust as necessary.

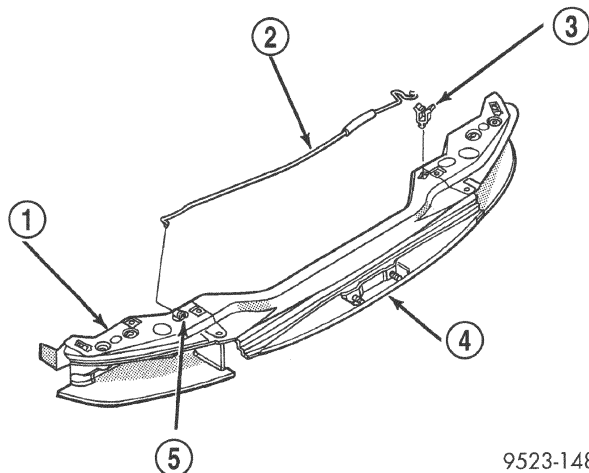
### HOOD PROP-ROD

#### REMOVAL

- (1) Release hood latch and open hood.

**CAUTION: Do place prop-rod or substitute against outer hood panel, damage to exterior finish will result.**

- (2) Prop hood open using a length of wooden dowel rod, ex (Broomstick).
- (3) Disengage prop-rod from retainer attaching prop-rod to radiator closure panel (Fig. 22).
- (4) Remove prop-rod from vehicle.



9523-148

**Fig. 22 Hood Prop Rod**

- 1 - RADIATOR CLOSURE PANEL
- 2 - HOOD PROP-ROD
- 3 - CLIP
- 4 - RADIATOR SUPPORT CROSSMEMBER
- 5 - RETAINER

### INSTALLATION

**CAUTION: Do place prop-rod or substitute against outer hood panel, damage to exterior finish will result.**

- (1) Place prop-rod into position.
- (2) Engage prop-rod from retainer attaching prop-rod to radiator closure panel.
- (3) Remove temporary hood prop rod.
- (4) Close hood.

### HOOD HINGE

#### REMOVAL

- (1) Support hood on the side that requires hinge replacement.
- (2) Mark all bolt and hinge attachment locations with a grease pencil or other suitable device to aid installation.
- (3) Remove cowl cover.
- (4) Remove bolts attaching hood to hinge.
- (5) Remove bolts attaching hood hinge to front fender flange and remove hinge from vehicle.

#### INSTALLATION

- (1) If necessary, paint new hinge before installation.
- (2) Place hinge in position on vehicle.
- (3) Install bolts to attach hood hinge to front fender flange.
- (4) Install bolts to attach hood to hinge.
- (5) Align all marks and secure bolts. The hood should be aligned to 4 mm (0.160 in.) gap to the front fenders and flush across the top surfaces along fenders. Shims can be added or removed under hood hinge to achieve proper hood height.
- (6) Install cowl cover.
- (7) Verify hood latch operation. Adjust as necessary.

### HOOD ADJUSTER BUMPER

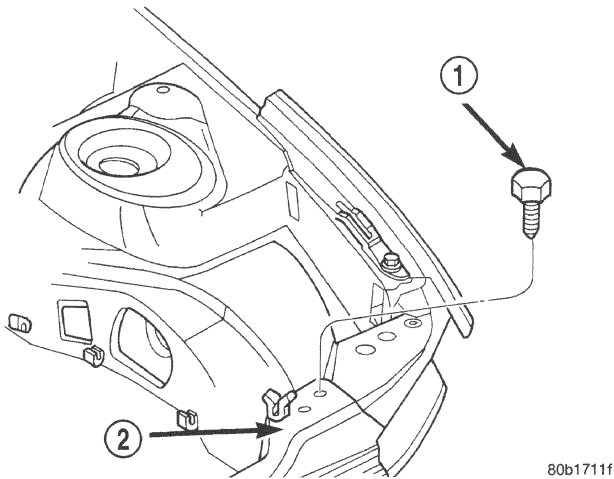
#### REMOVAL

- (1) Release hood latch and open hood.
- (2) Rotate hood adjuster bumper counterclockwise.
- (3) Remove hood adjuster bumper from radiator closure panel (Fig. 23).

#### INSTALLATION

- (1) Start hood adjuster bumper into radiator closure panel.
- (2) Rotate hood adjuster bumper clockwise. Adjust hood adjuster bumper to achieve a hood height that is flush across the gaps to the fenders.
- (3) Close hood.

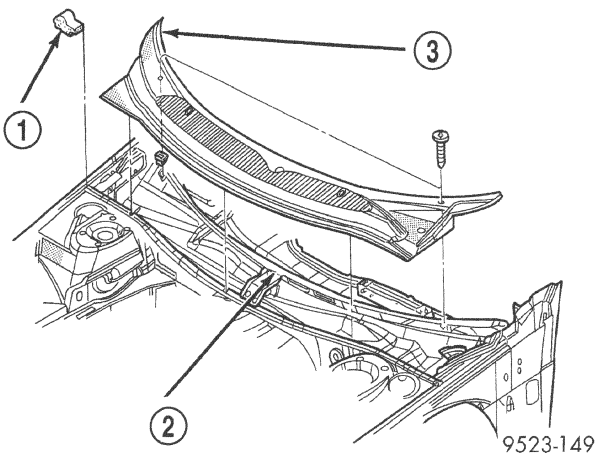


**REMOVAL AND INSTALLATION (Continued)****Fig. 23 Hood Adjuster Bumper**

- 1 - HOOD ADJUSTER BUMPER  
2 - UPPER RADIATOR CROSSMEMBER

**COWL COVER****REMOVAL**

- (1) Release hood latch and open hood.
- (2) Remove windshield wiper arms. Refer to Group 8K, Windshield Wipers and Washers.
- (3) Remove screws attaching cowl cover to cowl (Fig. 24).
- (4) Remove the seal, cowl screen to hood inner panel.
- (5) Remove clips attaching cowl cover to cowl plenum under hood to cowl bulb seal.
- (6) Remove cowl cover from vehicle.

**Fig. 24 Cowl Cover**

- 1 - SEAL  
2 - COWL  
3 - COWL COVER

**INSTALLATION**

- (1) Position cowl cover to vehicle.
- (2) Install clips attaching cowl cover to cowl plenum.
- (3) Install the seal, cowl screen to hood inner panel.
- (4) Install screws attaching cowl cover to cowl.
- (5) Install windshield wiper arms. Refer to Group 8K, Windshield Wipers and Washers.

**BATTERY SPLASH SHIELD****REMOVAL**

- (1) Remove screws attaching battery splash shield to front bumper fascia (Fig. 25).
- (2) Rotate half turn retainers attaching battery splash shield to wheelhouse splash shield counter-clockwise.
- (3) Remove battery splash shield from wheelhouse splash shield.
- (4) Remove battery splash shield from vehicle.

**INSTALLATION**

- (1) Place battery splash shield into position.
- (2) Install battery splash shield to wheelhouse splash shield.
- (3) Rotate half turn retainers attaching battery splash shield to wheelhouse splash shield clockwise.
- (4) Install screws attaching battery splash shield to front bumper fascia.

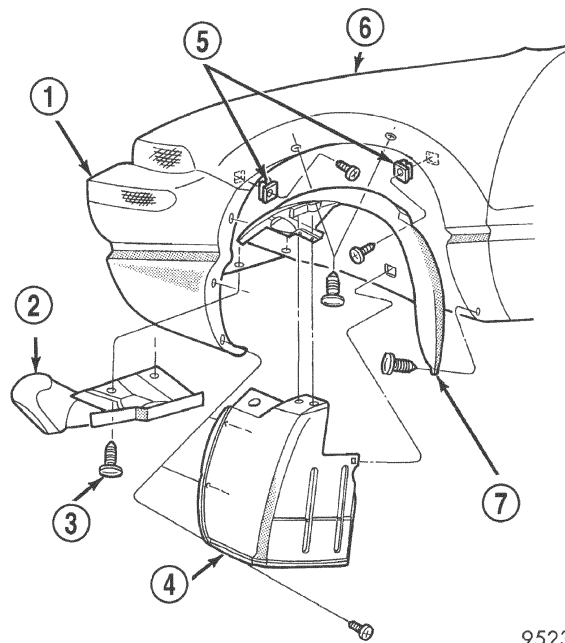
**LEFT FRONT WHEELHOUSE SPLASH SHIELD****REMOVAL**

- (1) Hoist and support vehicle on safety stands.
- (2) Remove left front wheel. Refer to Group 22, Wheels and Tires, for proper procedures.
- (3) Remove battery splash shield.
- (4) Remove screws attaching wheelhouse splash shield to front fender lip (Fig. 25).
- (5) Remove push-in fastener attaching wheelhouse splash shield to fender at the rocker panel.
- (6) Remove push-in fasteners attaching wheelhouse splash shield to fender support.
- (7) Remove wheelhouse splash shield from vehicle.

**INSTALLATION**

- (1) Place wheelhouse splash shield into position.
- (2) Install push-in fasteners attaching wheelhouse splash shield to fender support.
- (3) Install push-in fastener attaching wheelhouse splash shield to fender at the rocker panel.
- (4) Install screws attaching wheelhouse splash shield to front fender lip.
- (5) Install battery splash shield.
- (6) Install left front wheel.

## REMOVAL AND INSTALLATION (Continued)



**Fig. 25 Left Front Wheelhouse Splash Shield**

- 1 - FASCIA
- 2 - LOWER SPLASH SHIELD
- 3 - PUSH-IN FASTENER
- 4 - BATTERY SPLASH SHIELD
- 5 - NUT-SNAP
- 6 - FENDER
- 7 - WHEELHOUSE SPLASH SHIELD

(7) Remove vehicle from hoist.

## ACCESSORY DRIVE BELT SPLASH SHIELD

### REMOVAL

- (1) Remove screw attaching accessory drive belt splash shield to front fender (Fig. 26).
- (2) Remove push-in fasteners attaching accessory drive belt splash shield to frame rail.
- (3) Remove accessory drive belt splash shield from vehicle.

### INSTALLATION

- (1) Place accessory drive belt splash shield into position.
- (2) Install push-in fasteners attaching accessory drive belt splash shield to frame rail.
- (3) Install screw attaching accessory drive belt splash shield to front fender.

## RIGHT FRONT WHEELHOUSE SPLASH SHIELD

### REMOVAL

- (1) Hoist and support vehicle on safety stands.
- (2) Remove right front wheel.

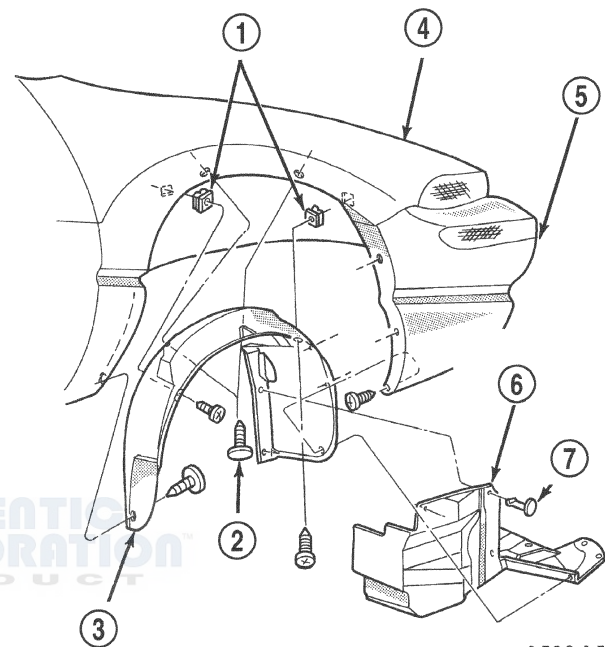
(3) Remove screws attaching wheelhouse splash shield to front fender lip (Fig. 26).

(4) Remove screws attaching wheelhouse splash shield to front bumper fascia.

(5) Remove push-in fastener attaching wheelhouse splash shield to fender at rocker panel.

(6) Remove push-in fasteners attaching wheelhouse splash shield to fender support.

(7) Remove wheelhouse splash shield from vehicle.

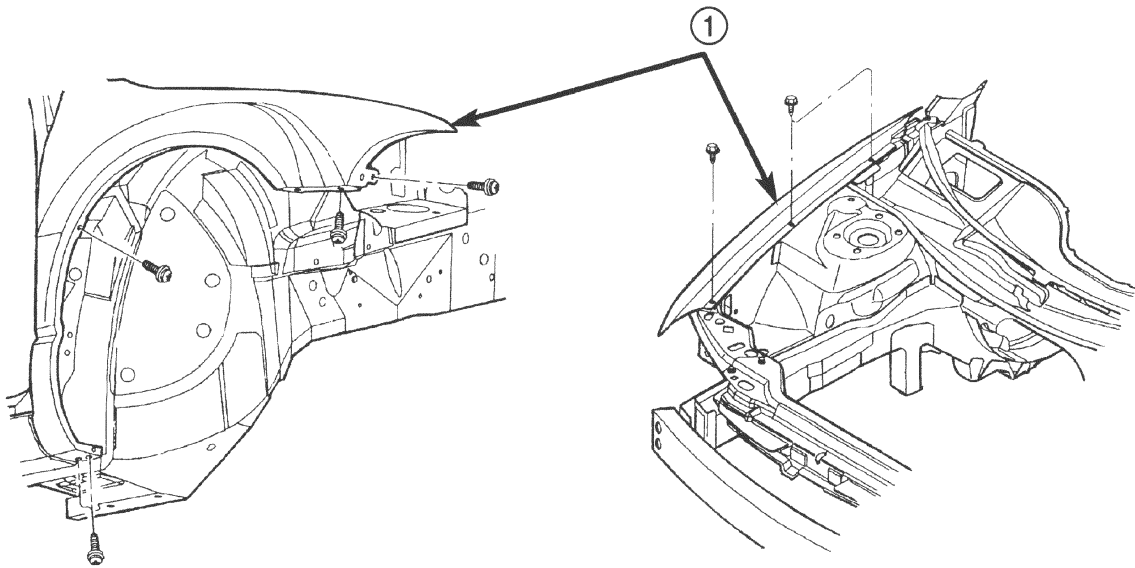


**Fig. 26 Right Front Wheelhouse Splash Shield**

- 1 - NUT-SNAP
- 2 - PUSH-IN FASTENER
- 3 - WHEELHOUSE SPLASH SHIELD
- 4 - FENDER
- 5 - FASCIA
- 6 - ACCESSORY DRIVE BELT SPLASH SHIELD
- 7 - PUSH-IN FASTENER

### INSTALLATION

- (1) Place wheelhouse splash shield into position.
- (2) Install push-in fasteners attaching wheelhouse splash shield to fender support.
- (3) Install push-in fastener attaching wheelhouse splash shield to fender at rocker panel.
- (4) Install screws attaching wheelhouse splash shield to front bumper fascia.
- (5) Install screws attaching wheelhouse splash shield to front fender lip.
- (6) Install right front wheel.
- (7) Remove vehicle from Hoist.

**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 27 Fender**

1 - FENDER

**FENDER****REMOVAL**

- (1) Remove headlamp housing.
- (2) Remove mud guard.
- (3) Remove inner splash shield.
- (4) Remove fender to fascia bolt.
- (5) Remove fender bolt to lower rocker panel.
- (6) Remove fender bolt to lower cowl.
- (7) Pull fascia away from fender.
- (8) Remove bolts attaching fender to upper rail.
- (9) Remove fender from vehicle (Fig. 27).

**INSTALLATION**

- (1) Place fender in position on vehicle.
- (2) Start the center upper rail bolt.
- (3) From inside engine compartment, start the center upper rail bolt. install all the bolts attaching fender to upper rail and tighten.
- (4) Install fender to lower cowl panel bolt.
- (5) Install fender to rocker panel bolt.
- (6) Place fascia into position.
- (7) Install fender to fascia bolt.
- (8) Install inner splash shield.
- (9) Install mud guard.
- (10) Install headlamp assembly.
- (11) Check fender for flush and gap.

**EXTERIOR BADGEING ATTACHED WITH DOUBLE SIDED FOAM TAPE****REMOVAL**

- (1) Mark reference points before removing.

(2) Using a heat gun gently apply heat in a circular motion to loosen the adhesive bond.

(3) Using a nonmetallic prying device, such as a plastic or wood trim stick gently pry up at corners and remove.

(4) Clean off all traces of adhesive or double sided tape from the panel with a general purpose adhesive remover.

**INSTALLATION**

- (1) Clean panel surface with isopropyl alcohol.
- (2) Align badgeing to reference points.
- (3) Install and press securely to full adhesive contact.
- (4) Clean away any reference points.

**EXTERIOR BADGEING/TAPE STRIPES ATTACHED WITH ADHESIVES****REMOVAL**

- (1) Mark reference points before removing.
- (2) Using a heat gun gently apply heat in a circular motion to loosen the adhesive bond.
- (3) With your fingernail lift up and peel away badgeing/tape from panel, using a heat gun as you go.
- (4) Clean off all traces of adhesive from the panel(s) with a general purpose adhesive remover.

**INSTALLATION**

- (1) Clean panel surface with isopropyl alcohol.
- (2) Remove paper carrier and align badgeing/tape to reference points or adjacent panel.



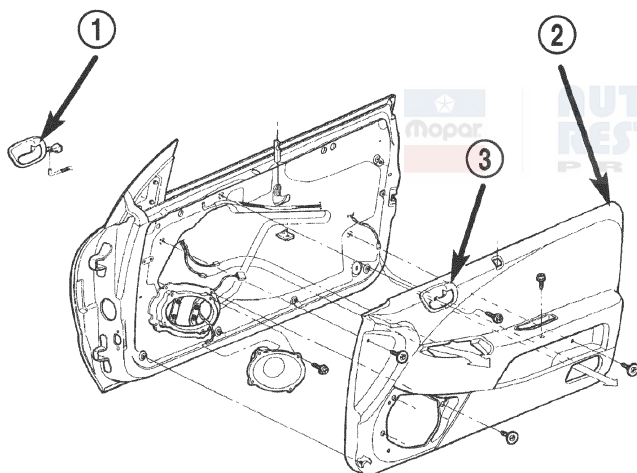
## REMOVAL AND INSTALLATION (Continued)

- (3) Install and press securely, using a plastic spreader to eliminate all air bubbles.
- (4) Remove top protective carrier.
- (5) Clean away any reference points.

### DOOR TRIM PANEL

#### REMOVAL

- (1) Roll door glass down.
- (2) Disengage clips holding speaker grille to door trim panel.
- (3) Remove screws holding door trim panel to door (Fig. 28).
- (4) Disengage clips holding perimeter of trim panel to door (Fig. 28).
- (5) Lift trim panel upward and disengage trim panel from upper retainer channel.
- (6) Tilt trim panel away from door.
- (7) Disengage clip holding latch linkage to back of inside door handle.
- (8) Disconnect electrical connectors as necessary.
- (9) Remove door trim panel from door.



**Fig. 28 Door Trim Panel Clips**

- 1 - INSIDE DOOR HANDLE
- 2 - FRONT DOOR TRIM PANEL
- 3 - INSIDE DOOR HANDLE

#### INSTALLATION

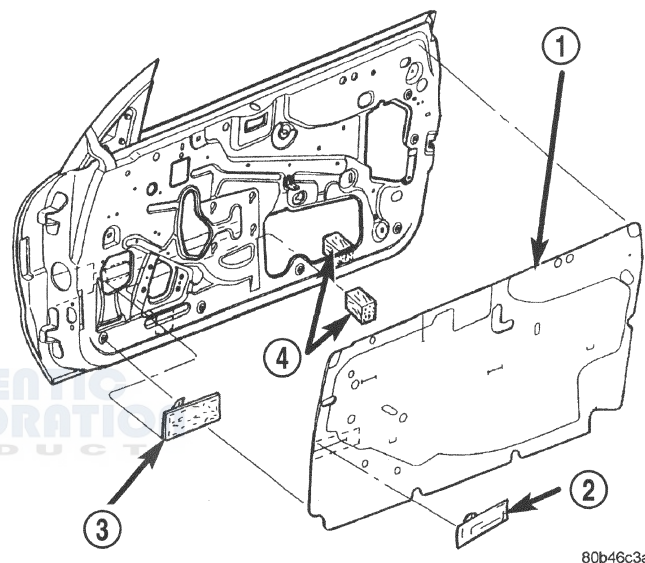
- (1) Position door trim panel next to door.
- (2) Connect electrical connectors as necessary.
- (3) Engage clip holding latch linkage to inside door handle.
- (4) Position door trim panel on door and engage trim panel to upper retainer channel.
- (5) Engage clips holding perimeter of trim panel to door.
- (6) Install screws holding trim panel to door.

- (7) Engage clips holding speaker grille to door trim panel.

### DOOR WATER DAM

#### REMOVAL

- (1) Remove door trim panel.
- (2) Remove door speaker, if equipped.
- (3) Remove door trim pull cup mount bracket.
- (4) Disengage clip attaching lock linkage to lock button bell crank.
- (5) Peel water dam away from adhesive around perimeter of inner door panel (Fig. 29).



**Fig. 29 Door Water Dam**

- 1 - DOOR WATERSHIELD
- 2 - TAPE
- 3 - ANTI RATTLE TAPE FOAM
- 4 - FOAM BLOCK

#### INSTALLATION

- (1) Insure that enough adhesive remains to securely retain the water dam. Replace as necessary.
- (2) Place the water dam into position and press securely to adhesive making sure to properly route wiring and linkages.
- (3) Engage clip attaching lock linkage to lock button bell crank.
- (4) Install door trim pull cup mount bracket.
- (5) Install door speaker, if equipped.
- (6) Install door trim panel.

### DOOR OUTSIDE HANDLE

#### REMOVAL

- (1) Remove door trim panel.
- (2) Raise door glass.



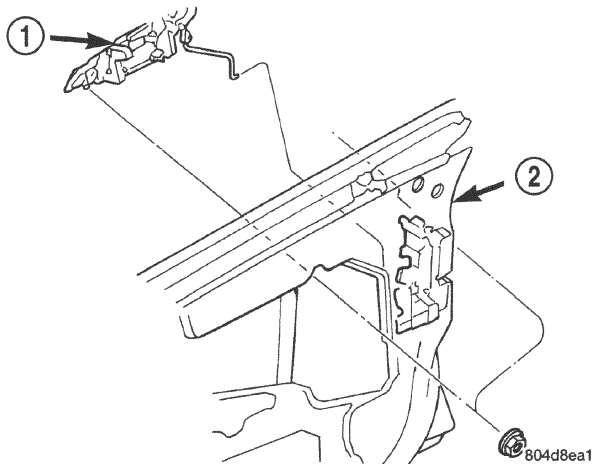
**REMOVAL AND INSTALLATION (Continued)**

(3) Remove watershield as necessary to gain access.

(4) Disconnect latch rod at door latch.

(5) Remove nuts holding door handle to outer door panel (Fig. 30).

(6) Remove outside door handle from door.



**Fig. 30 Outside Door Handle**

- 1 - OUTSIDE DOOR HANDLE  
2 - DOOR

**INSTALLATION**

- (1) Position outside door handle on door.
- (2) Install nuts holding door handle to outer door panel.
- (3) Connect latch rod at door latch.
- (4) Install watershield.
- (5) Install door trim panel.
- (6) Verify door handle operation. Adjust door latch as necessary.

**DOOR LOCK CYLINDER****REMOVAL**

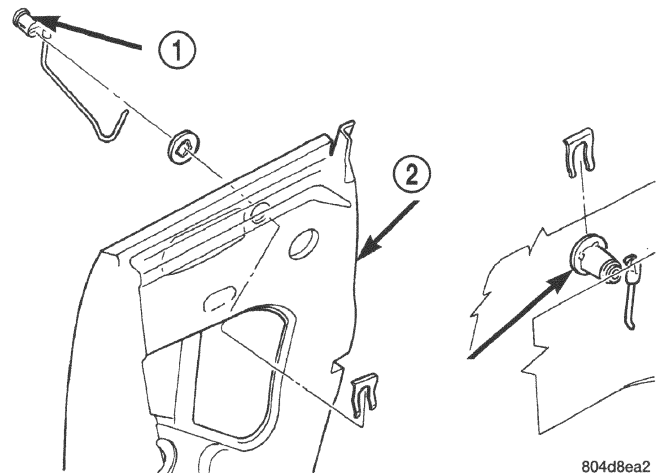
- (1) Remove outside door handle.
- (2) Remove clip attaching lock cylinder to outside door panel (Fig. 31).
- (3) Disengage clip attaching link to key cylinder.
- (4) Remove lock cylinder from outer door panel.

**INSTALLATION**

- (1) Position lock cylinder and gasket in door outer panel.
- (2) Install clip attaching lock cylinder to outside door panel.
- (3) Engage link to key cylinder.
- (4) Install outside door handle.

**LOCK CYLINDERS**

Ignition, door, deck lid, and rear hatch lock cylinders are all codable to the key. Lock barrels, tum-



**Fig. 31 Door Lock Cylinder**

- 1 - DOOR LOCK CYLINDER  
2 - DOOR  
3 - DOOR LOCK CYLINDER

blers, and tumbler springs are available to allow the technician to change replacement locks cylinders to match the customer's original key set. See the appropriate section in this manual for lock cylinder removal. See the Mopar® catalogue for part numbers and lock coding procedures.

**DOOR LATCH****REMOVAL**

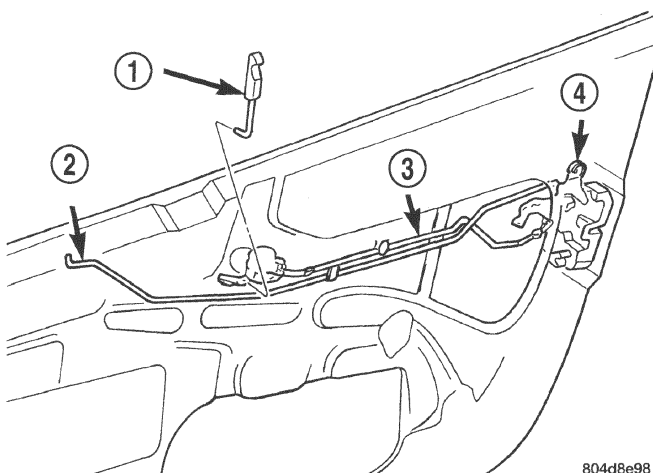
- (1) Remove door trim panel and watershield.
- (2) Raise door glass.
- (3) Disconnect lock rod from lock button bellcrank.
- (4) Disengage lock and latch rods from clips on inner door panel (Fig. 32).
- (5) Disconnect lock and latch rods from outside door handle and key cylinder at door latch (Fig. 33).
- (6) Disconnect wire connector from power door lock motor.
- (7) Remove screws attaching door latch to door end frame (Fig. 34).
- (8) Remove door latch from vehicle.

**INSTALLATION**

**CAUTION:** Do not close door before adjusting the door latch. Door may fail to reopen.

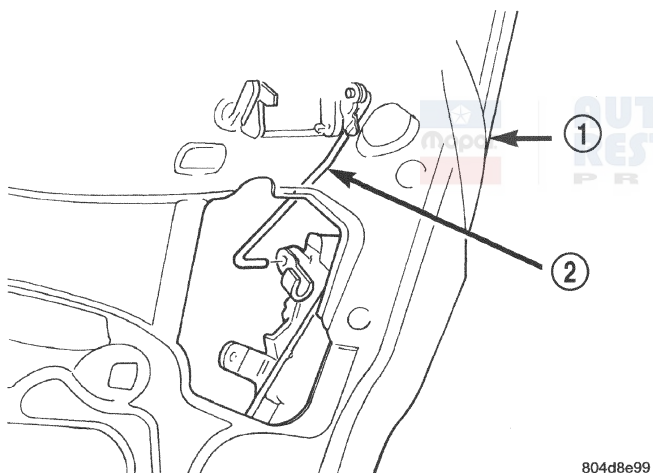
- (1) Position door latch on vehicle.
- (2) Install screws attaching door latch to door end frame.
- (3) Connect wire connector to power door lock motor.
- (4) Connect lock and latch rods from outside door handle and key cylinder at door latch.

## REMOVAL AND INSTALLATION (Continued)



**Fig. 32 Latch and Lock Rod Clips**

- 1 - INSIDE LOCK BUTTON
- 2 - LATCH ROD
- 3 - LOCK ROD
- 4 - DOOR LATCH



**Fig. 33 Lock and Latch Rods At Door Latch**

- 1 - DOOR
- 2 - DOOR LATCH ROD

(5) Engage lock and latch rods to clips on inner door panel.

(6) Connect lock rod from lock button bellcrank.

(7) Adjust door latch.

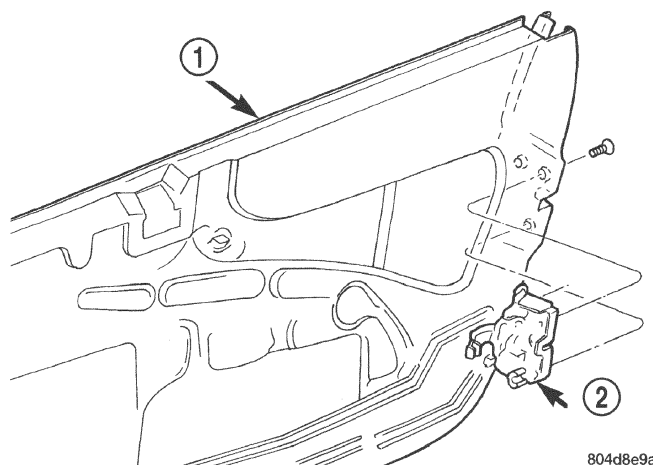
(8) Verify operation of door latch. Readjust if necessary.

(9) Install door trim panel and watershield.

## DOOR LATCH STRIKER

### REMOVAL

(1) Mark outline of door latch striker on B-pillar to aid in installation.



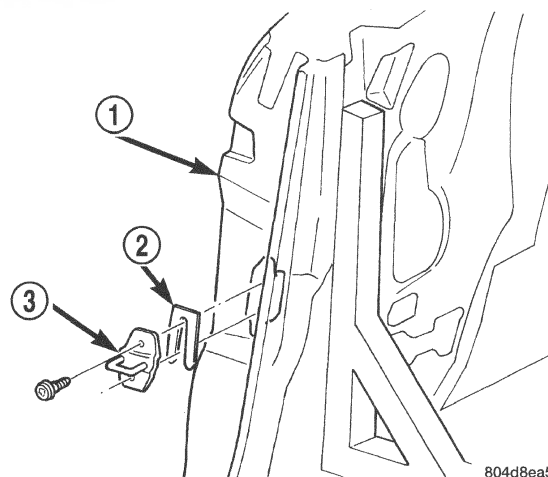
**Fig. 34 Door Latch**

- 1 - DOOR
- 2 - DOOR LATCH

(2) Remove screws attaching door latch striker to B-pillar (Fig. 35).

(3) Remove latch striker from vehicle.

**NOTE:** Be sure to check for any shims between door latch striker and B-pillar. If any shims are found, they must be reinstalled with the new door latch striker to maintain proper door operation.



**Fig. 35 Door Latch Striker**

- 1 - B-PILLAR
- 2 - SHIM
- 3 - DOOR LATCH STRIKER

### INSTALLATION

(1) Position door latch striker and any shims on vehicle.

(2) Loosely install screws attaching latch striker to B-pillar.

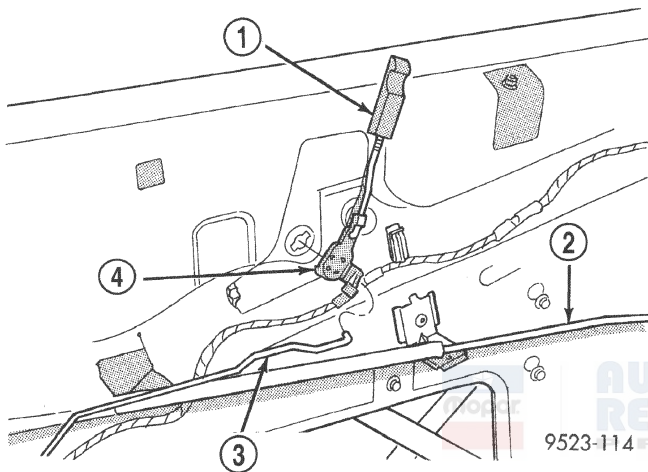
(3) Align latch striker to marks on B-pillar made previously.

**REMOVAL AND INSTALLATION (Continued)**

- (4) Tighten all fasteners.
- (5) Verify door fit and operation. Adjust door latch striker as necessary.

**LOCK BUTTON BELL CRANK****REMOVAL**

- (1) Remove door trim panel.
- (2) Disengage clip holding lock linkage to bell crank.
- (3) Rotate bell crank until retaining ears align with slots in door panel.
- (4) Remove bell crank from door (Fig. 36).

**Fig. 36 Lock Button Bell Crank – Typical**

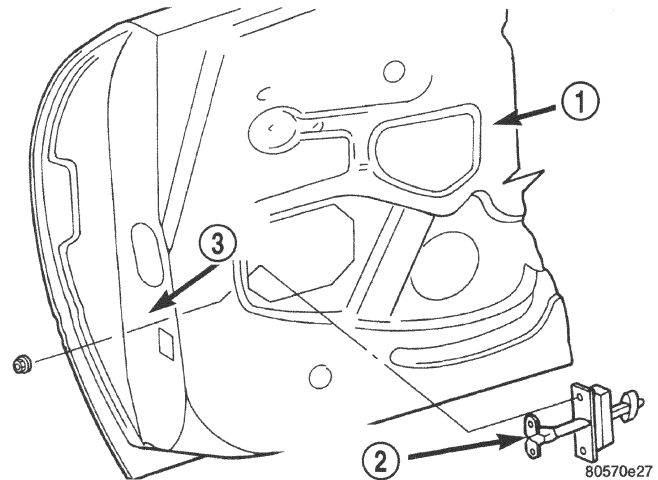
- 1 – LOCK BUTTON
- 2 – LATCH LINKAGE
- 3 – LOCK LINKAGE
- 4 – BELL-CRANK

**INSTALLATION**

- (1) Place bell crank into position.
- (2) Rotate bell crank until retaining ears align with slots in door panel.
- (3) Engage clip attaching lock linkage to bell crank.
- (4) Install door trim panel.

**DOOR CHECK STRAP****REMOVAL**

- (1) Remove door trim panel.
- (2) Remove watershield as necessary to gain access.
- (3) Remove bolts attaching check strap to lower A-pillar.
- (4) Remove bolts attaching check strap to door end frame (Fig. 37).
- (5) Remove door check strap from vehicle.

**Fig. 37 Door Check Strap**

- 1 – DOOR
- 2 – DOOR CHECK STRAP
- 3 – DOOR FACE

**INSTALLATION**

- (1) Position door check strap on vehicle.
- (2) Install bolts attaching check strap to door end frame.
- (3) Install bolts attaching check strap to lower A-pillar.
- (4) Install watershield.
- (5) Install door trim panel.

**DOOR****REMOVAL**

**NOTE:** The retaining clips used on the door hinge pins are not to be reused. Verify availability prior to proceeding.

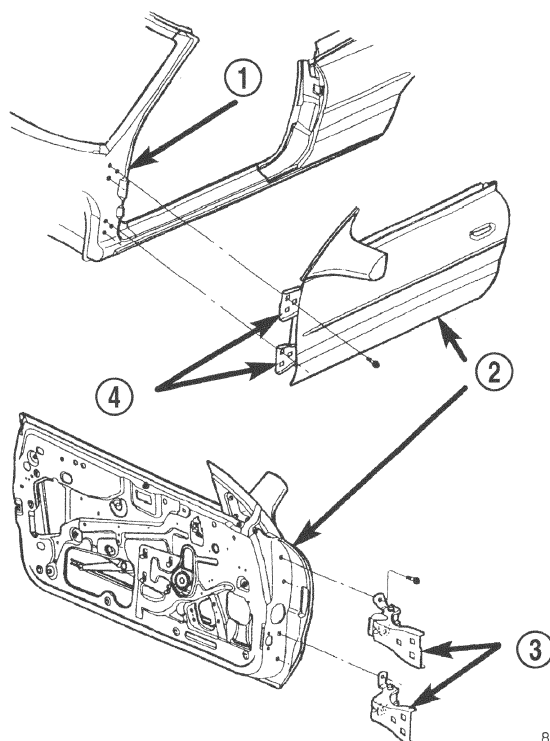
- (1) Open and support door on a suitable lifting device.
- (2) Disengage wire connector at hinge pillar.
- (3) Remove bolts attaching door check strap to hinge pillar.
- (4) Remove clip attaching hinge pin in lower door hinge.
- (5) Remove pin from lower hinge (Fig. 38).
- (6) Remove clip attaching hinge pin in upper hinge.
- (7) Remove pin from upper hinge (Fig. 38).
- (8) Remove door from vehicle.

**INSTALLATION**

- (1) Apply Mopar® Multi-mileage Grease to inside of door hinge bushings.
- (2) Position door on vehicle and install pin in upper hinge. Align knurling on hinge pin with the



## REMOVAL AND INSTALLATION (Continued)



**Fig. 38 Door**

- 1 - HINGE PILLAR
- 2 - DOOR
- 3 - HINGES
- 4 - HINGES

grooves in the door hinge prior to driving in the hinge pin.

- (3) Install pin in lower hinge.

**NOTE:** Verify that head of each hinge pin is fully seated into door hinge.

- (4) Install new clip attaching hinge pin in upper hinge.

- (5) Install new clip attaching pin in lower hinge.

- (6) Install bolts attaching door check strap to hinge pillar.

- (7) Engage wire connector at hinge pillar.

## DOOR HINGE

**NOTE:** If both hinges on one door are to be replaced, remove and install one hinge completely prior to beginning the second hinge.

## REMOVAL

- (1) Open and support door on a suitable lifting device.

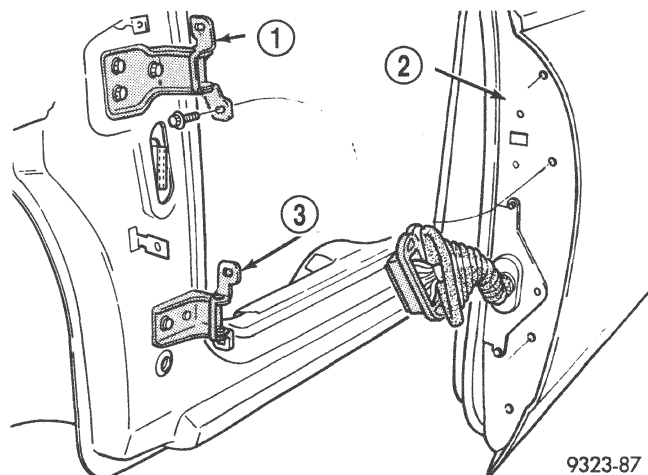
- (2) Remove bolts attaching door check strap to lower A-pillar for greater access, if necessary.

- (3) Mark position of hinge on both the door end frame and lower A-pillar to ease installation.

- (4) Remove bolts attaching hinge to door end frame (Fig. 39).

- (5) Remove bolts attaching hinge to lower A-pillar.

- (6) Remove door hinge from vehicle.



**Fig. 39 Door and Hinge - Typical**

- 1 - UPPER HINGE
- 2 - FRONT DOOR
- 3 - LOWER HINGE

## INSTALLATION

**CAUTION:** When installing a new hinge, make sure that the head of each hinge pin is fully seated into the door hinge. Also, remove the plastic shipping clip and replace it with the correct metal retaining clip once the hinge pin is seated.

- (1) If necessary, paint new door hinge prior to installation.

- (2) Position door hinge on vehicle.

- (3) Loosely install bolts attaching hinge to lower A-pillar.

- (4) Loosely install bolts attaching hinge to door end frame.

- (5) Align hinge to marks made previously and tighten all bolts.

- (6) Install bolts attaching door check strap to lower A-pillar, if removed previously.

- (7) Verify door fit and operation. Adjust door hinge for proper door alignment, if necessary.

## DOOR OUTER BELT WEATHERSTRIP

### REMOVAL

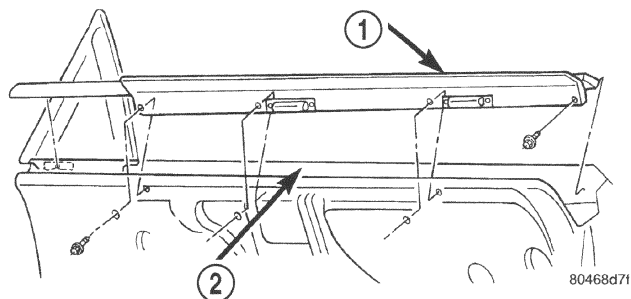
- (1) Remove door glass.

- (2) Remove screws attaching outer belt weatherstrip to outer door panel (Fig. 40).



**REMOVAL AND INSTALLATION (Continued)**

(3) Remove outer belt weatherstrip from the vehicle.



**Fig. 40 Door Outer Belt Weatherstrip**

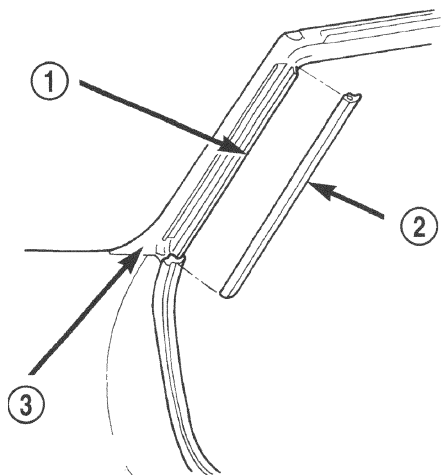
- 1 - DOOR OUTER BELT WEATHERSTRIP  
2 - OUTER DOOR PANEL

**INSTALLATION**

- (1) Position outer belt weatherstrip on vehicle.
- (2) Install screws to hold outer weatherstrip to outer door panel.
- (3) Install door glass.

**DOOR OPENING TRIM WELT****REMOVAL**

- (1) Using trim stick, special tool C-4755, remove one end of door opening trim welt from door opening flange.
- (2) Remove welt from vehicle (Fig. 41).



**Fig. 41 Door Opening Trim Welt**

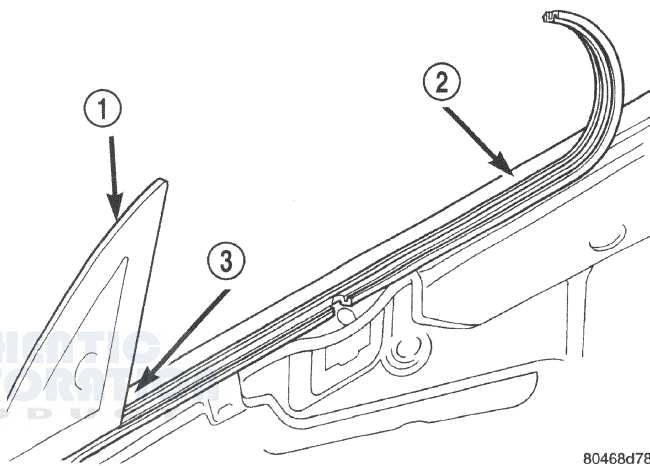
- 1 - DOOR OPENING FLANGE  
2 - DOOR OPENING TRIM WELT  
3 - HEADER A-PILLAR WEATHERSTRIP

**INSTALLATION**

- (1) Position door opening trim welt on vehicle.
- (2) Butt end of welt to edge of header/A-pillar weatherstrip.
- (3) Push door opening welt onto door opening flange.

**DOOR INNER BELT WEATHERSTRIP****REMOVAL**

- (1) Remove door trim panel.
- (2) Pull upward on rear edge of inner belt weatherstrip (Fig. 42).
- (3) Remove weatherstrip from vehicle.



**Fig. 42 Door Inner Belt Weatherstrip**

- 1 - MIRROR FLAG/GLASS CHANNEL  
2 - INNER BELT WEATHERSTRIP  
3 - START THIS END FIRST

**INSTALLATION**

- (1) Start leading edge of weatherstrip on vehicle.
- (2) Press the leading edge of the weatherstrip forward until edge is tight to the mirror flag.
- (3) Press weatherstrip into position on door panel.
- (4) Install door trim panel.

**DOOR GLASS****REMOVAL**

- (1) Remove door trim panel and watershield.
- (2) Remove inner door belt weatherstrip.
- (3) Loosen inner belt stabilizer (Fig. 43).
- (4) Remove door speaker, if so equipped.
- (5) Lower door glass to access glass attachment bolts.

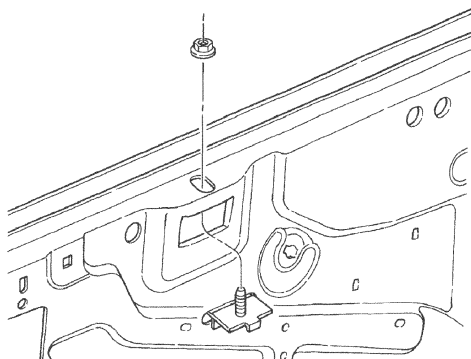
**REMOVAL AND INSTALLATION (Continued)**

(6) Remove bolts attaching regulator lift channel to door glass (Fig. 44).

(7) Remove bolts attaching rear guide plate to door glass (Fig. 45).

(8) Remove rear guide plate from door glass.

(9) Lift door glass upward and out of opening at top of door (Fig. 44).

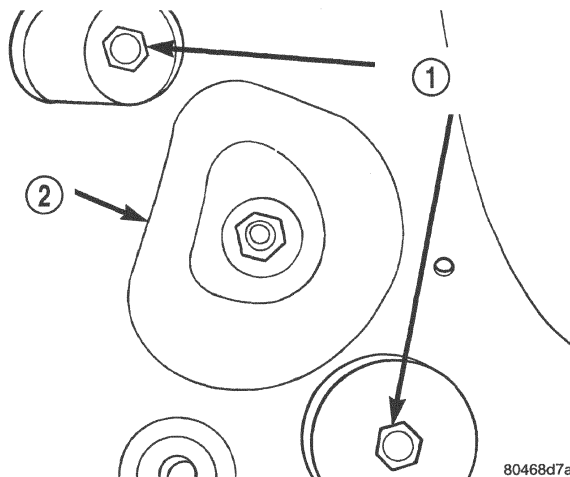


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**Fig. 43 Inner Belt Stabilizer****INSTALLATION**

(1) Carefully lower door glass through opening in top of door. Verify that the front edge of the glass is in the mirror flag glass channel.

(2) Position rear guide plate onto door glass and install bolts.



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**Fig. 45 Rear Guide Bolts**

- 1 - REAR GUIDE BOLTS  
2 - INNER DOOR PANEL

(3) Install nuts attaching regulator lift channel to door glass.

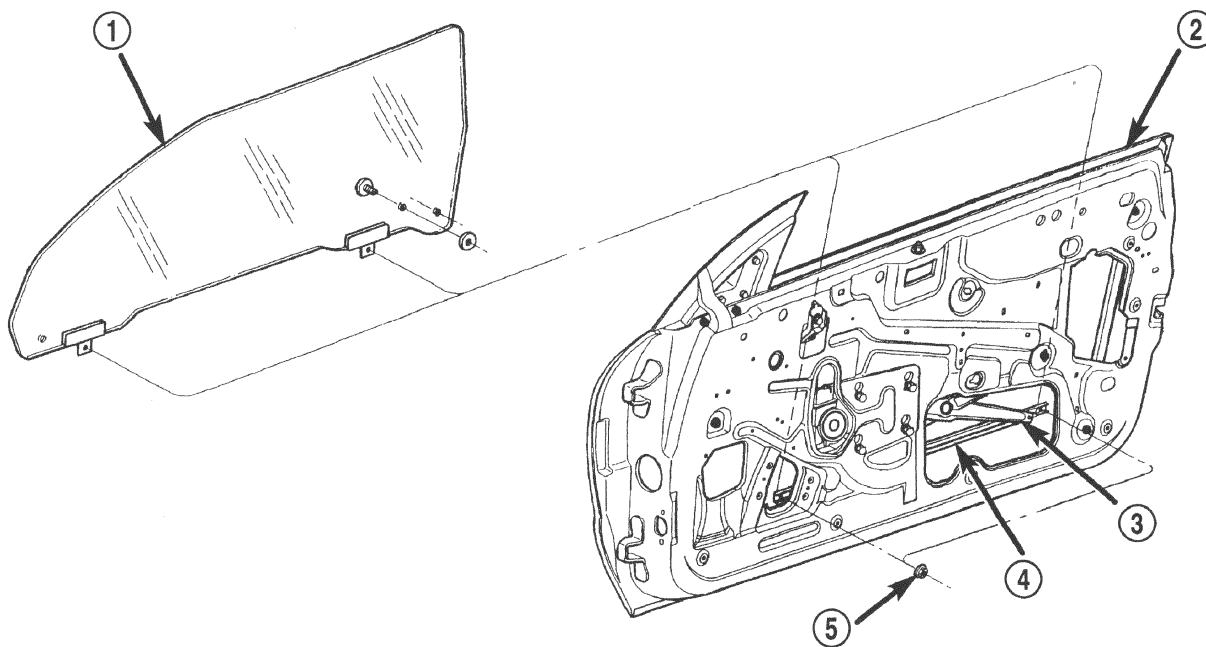
(4) Tighten all door glass fasteners.

(5) Install door speaker, if so equipped.

(6) Tighten window inner belt stabilizer.

(7) Install inner door belt weatherstrip.

(8) Install door trim panel and watershield.



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**Fig. 44 Regulator Lift Channel**

- 1 - DOOR GLASS  
2 - DOOR  
3 - WINDOW REGULATOR

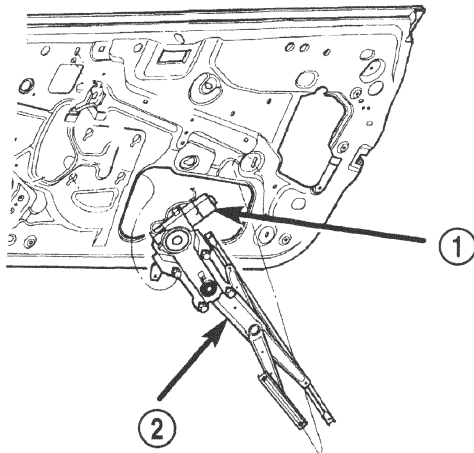
- 4 - LIFT CHANNEL  
5 - ROLLER CHANNEL NUT

**REMOVAL AND INSTALLATION (Continued)****DOOR WINDOW REGULATOR**

**NOTE:** For power window motor service procedures, refer to Group 8S, Power Windows.

**REMOVAL**

- (1) Remove door trim panel and water shield.
- (2) Disconnect wire connector to power window motor.
- (3) Remove nuts attaching regulator lift channel to door glass (Fig. 44).
- (4) Secure door glass in upward position.
- (5) Mark position of rear bolt of roller channel to inner door panel to aid in installation.
- (6) Remove bolt attaching rear of roller channel to door panel.
- (7) Loosen bolt attaching front of roller channel to door panel.
- (8) Remove roller channel from door panel (Fig. 46).
- (9) Loosen bolts attaching window regulator to inner door panel reinforcement.
- (10) Remove bolt heads from key hole slots in inner door panel.
- (11) Remove window regulator through large hole in inner door panel (Fig. 46).
- (12) Remove power window motor from regulator. Refer to Group 8S, Power Windows, for motor procedure.



**Fig. 46 Power Window Regulator**

- 1 - POWER WINDOW MOTOR  
2 - POWER WINDOW REGULATOR

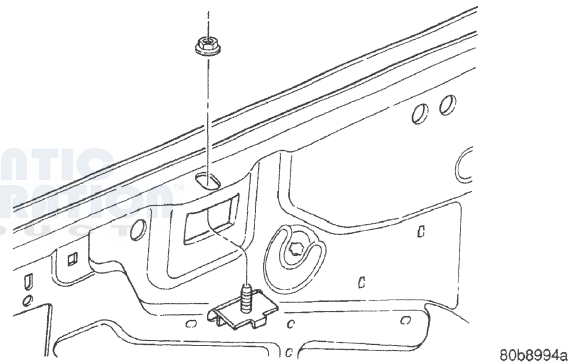
**INSTALLATION**

- (1) Install power window motor on regulator. Refer to group 8S, Power Windows, for motor procedures.
- (2) Move window regulator into position in door and engage bolt heads into key hole slots in inner door panel reinforcement and tighten bolts.

- (3) Install roller channel to door panel.
- (4) Install bolt at rear of roller channel. Make sure that bolt is aligned to mark on inner door panel made previously.
- (5) Tighten front and rear bolts of roller channel.
- (6) Install nuts attaching regulator lift channel to door glass.
- (7) Verify glass fit and operation. Adjust door glass, if necessary.
- (8) Connect wire connector to power window motor.
- (9) Install door trim panel and water shield.

**DOOR GLASS INNER BELT STABILIZER****REMOVAL**

- (1) Remove door trim panel.
- (2) Remove nut attaching inner belt stabilizer to door panel.
- (3) Remove inner belt stabilizer from door (Fig. 47).



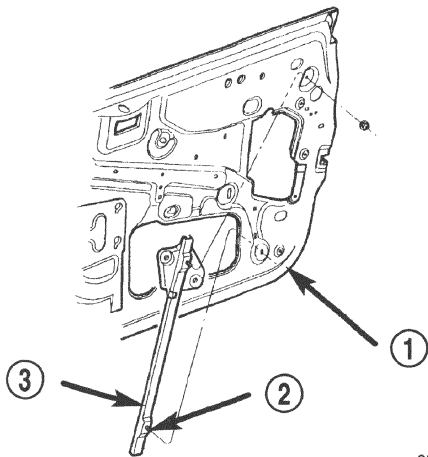
**Fig. 47 Inner Belt Stabilizer**

**INSTALLATION**

- (1) Place inner belt stabilizer into position.
- (2) Install nut attaching inner belt stabilizer to door panel. Adjust inner belt stabilizer against glass with enough tension to allow free up and down movement.
- (3) Install door trim panel.

**REAR VERTICAL GUIDE BAR****REMOVAL**

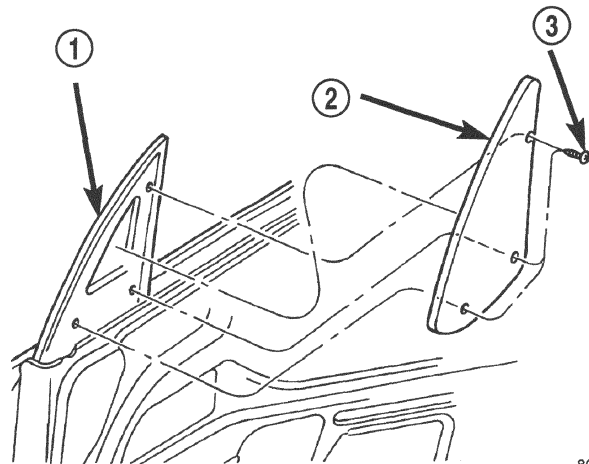
- (1) Remove door trim panel and watershield.
- (2) Remove nut attaching top of guide bar to inner door panel.
- (3) Using a suitable allen wrench, hold jack screw stationary while removing nut attaching bottom of guide bar to inner door panel.
- (4) Remove guide bar from vehicle and remove through access hole in inner door panel (Fig. 48).

**REMOVAL AND INSTALLATION (Continued)**

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**Fig. 48 Rear Vertical Guide Bar**

- 1 - DOOR
- 2 - JACK SCREW
- 3 - REAR VERTICAL GUIDE BAR



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**Fig. 49 Side View Mirror Cover**

- 1 - MIRROR FLAG
- 2 - SIDE VIEW MIRROR COVER
- 3 - FASTENERS

**INSTALLATION**

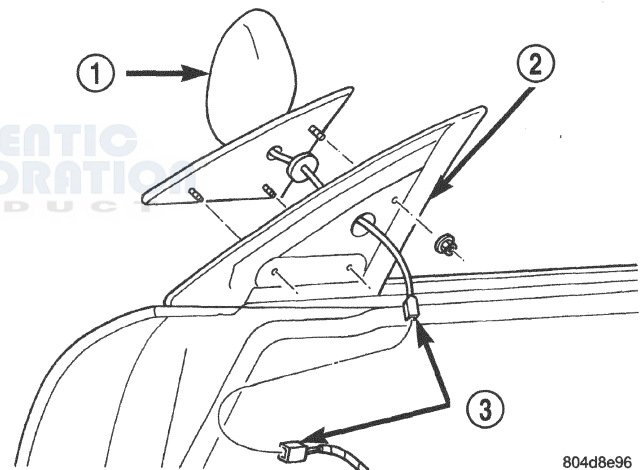
- (1) If a new guide bar is being installed, preset bottom jack screw using old guide bar as a reference.
- (2) Position rear guide bar on vehicle.
- (3) Using a suitable allen wrench, hold jack screw stationary while installing nut attaching bottom of guide bar to inner door panel.
- (4) Install nut attaching top of rear guide bar to inner door panel.
- (5) Verify glass fit and operation. Adjust door glass as necessary.
- (6) Install door trim panel and watershield.

**SIDE VIEW MIRROR****REMOVAL**

- (1) Remove side view mirror cover (Fig. 49).
- (2) Remove the door trim panel.
- (3) Disconnect power window mirror motor wire connector, if so equipped.
- (4) Disengage wire harness grommet from mirror flag, if so equipped.
- (5) Remove nuts attaching side view mirror to mirror flag (Fig. 50).
- (6) Remove side view mirror from vehicle.

**INSTALLATION**

- (1) Feed power mirror wire harness through hole in mirror flag and seat grommet. Do not pull on wire harness to seat grommet.
- (2) Position side view mirror to vehicle.
- (3) Install nuts attaching side view mirror to mirror flag.
- (4) Engage push in fastener attaching power mirror wire connector to inner door panel, if so equipped.



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**Fig. 50 Side View Mirror**

- 1 - SIDE VIEW MIRROR
- 2 - MIRROR FLAG/GLASS CHANNEL
- 3 - WIRE CONNECTOR

- (5) Engage power mirror motor wire connector, if so equipped.
- (6) Install side view mirror cover.

**SIDE VIEW MIRROR FLAG/DOOR GLASS CHANNEL****REMOVAL**

- (1) Remove side view mirror.
- (2) Remove door trim panel.
- (3) Remove door glass.
- (4) Remove door outer belt weatherstrip.
- (5) Remove screws attaching mirror flag/door glass channel to outer door panel (Fig. 51).

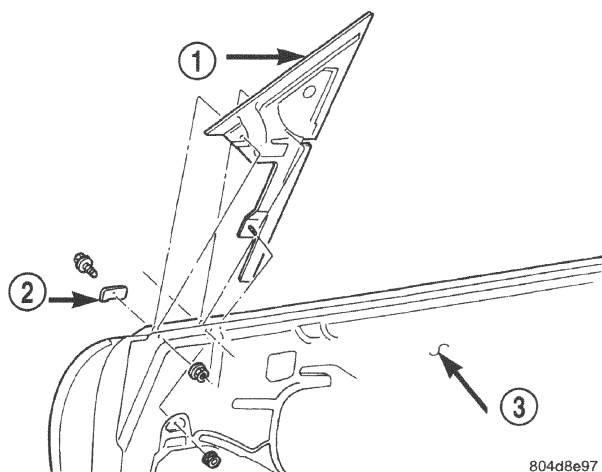


**REMOVAL AND INSTALLATION (Continued)**

(6) Remove nut attaching top of mirror flag/door glass channel to inner door panel.

(7) Using a suitable allen wrench, hold jack screw stationary while removing nut attaching bottom of mirror flag/door glass channel to inner door panel.

(8) Remove from vehicle and remove through opening in top of door.



**Fig. 51 Side View Mirror Flag/Door Glass Channel**

- 1 - MIRROR FLAG/GLASS CHANNEL
- 2 - CLIP
- 3 - DOOR

**INSTALLATION**

(1) If installing a new mirror flag/door glass channel, preset jackscrew using old flag/channel as a reference.

(2) Position mirror flag/door glass channel on vehicle.

(3) Using a suitable allen wrench, hold jack screw stationary while installing nut attaching bottom of mirror flag/door glass channel to inner door panel.

(4) Install nut attaching top of mirror flag/door glass channel to inner door panel.

(5) Install screws attaching mirror flag/door glass channel to outer door panel.

(6) Install door outer belt weatherstrip.

(7) Install door glass.

(8) Install side view mirror.

(9) Verify glass fit and operation. Adjust door glass as necessary.

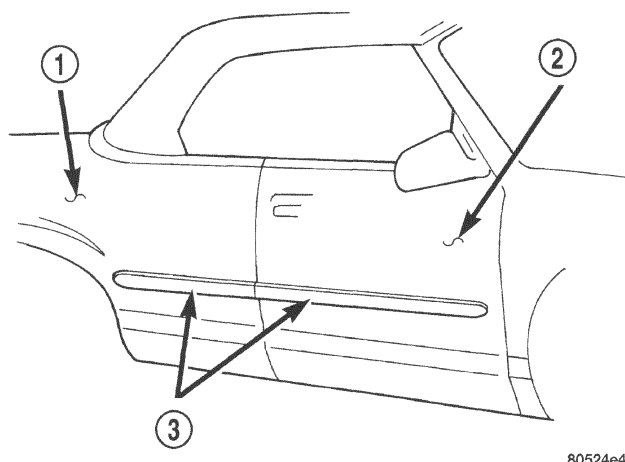
(10) Install door trim panel.

**BODY SIDE MOLDING****REMOVAL**

(1) Warm the affected body side molding and body metal to approximately 38° C (100° F) using a suitable heat lamp or heat gun.

(2) Pull body side molding from vehicle (Fig. 52).

(3) Remove adhesive tape residue from surface of vehicle.



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**Fig. 52 Body Side Molding**

- 1 - QUARTER PANEL
- 2 - DOOR
- 3 - BODYSIDE MOLDING

**INSTALLATION**

(1) If molding is to be reused, remove tape residue from molding. Clean back of molding with Mopar® Super Kleen solvent or equivalent. Wipe molding dry with lint free cloth. Apply new body side molding (two sided adhesive) tape to back of molding.

(2) Clean body surface with Mopar® Super Kleen solvent or equivalent. Wipe surface dry with a lint free cloth.

(3) Apply a length of masking tape on the body parallel to the top edge of the molding to use as a guide, if necessary.

(4) Remove protective cover from tape on back of molding. Apply molding to body below the masking tape guide.

(5) Remove masking tape guide. Heat body metal and body side molding to approximately 38° C (100° F) using a suitable heat lamp or heat gun.

(6) Firmly press body side molding to body surface to insure adhesion.

**DECKLID****REMOVAL**

(1) Release decklid latch and open decklid.

(2) Mark outline of hinge on decklid to aid in installation (Fig. 53).

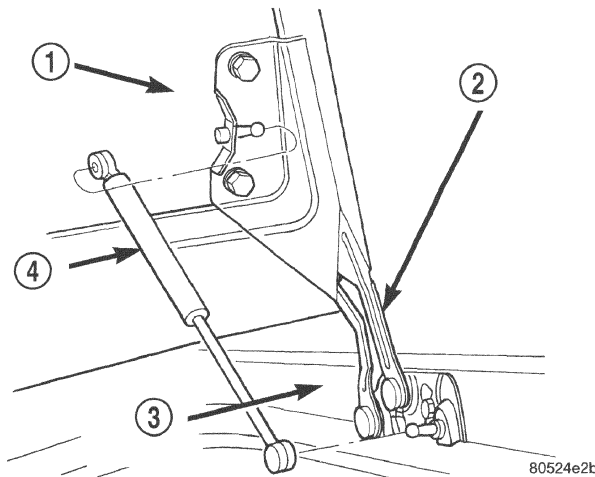
(3) Disconnect all wire connectors from decklid latch and disconnect wire harness from decklid.

(4) Place suitable padding between decklid and deck panel to protect paint finish.

(5) With aid of a helper, remove bolts attaching decklid to decklid hinge.

## REMOVAL AND INSTALLATION (Continued)

- (6) Remove decklid from vehicle.



**Fig. 53 Decklid Hinge And Gas Support Cylinder**

- 1 - TRUNK LID  
2 - TRUNK HINGE  
3 - QUARTER PANEL TROUGH  
4 - GAS SUPPORT CYLINDER

### INSTALLATION

- (1) Position decklid on vehicle.
- (2) With aid of a helper, loosely install bolts attaching decklid to decklid hinge.
- (3) Align marks made on decklid previously to decklid hinge and tighten bolts attaching decklid to decklid hinge.
- (4) Connect all wire connectors to decklid latch and install wire harness to decklid.
- (5) Verify fit of decklid to deck panel. Adjust as necessary.

## DECKLID HINGE AND GAS SUPPORT CYLINDER

### REMOVAL

- (1) Release decklid latch and open decklid.
- (2) Mark outline of decklid hinge on decklid and quarter panel trough to aid in installation.
- (3) Place suitable padding to cover deck panel in order to protect paint finish.
- (4) Using a suitable wooden dowel or other prop rod, support decklid.
- (5) Pull out caps at each end of gas support cylinder.
- (6) Disconnect gas support cylinder from decklid hinge by prying cylinder from ball stud on hinge (Fig. 53).
- (7) With aid of a helper, remove bolts attaching decklid hinge to decklid.

- (8) Remove bolts attaching decklid hinge to quarter panel.

- (9) Remove decklid hinge from vehicle.

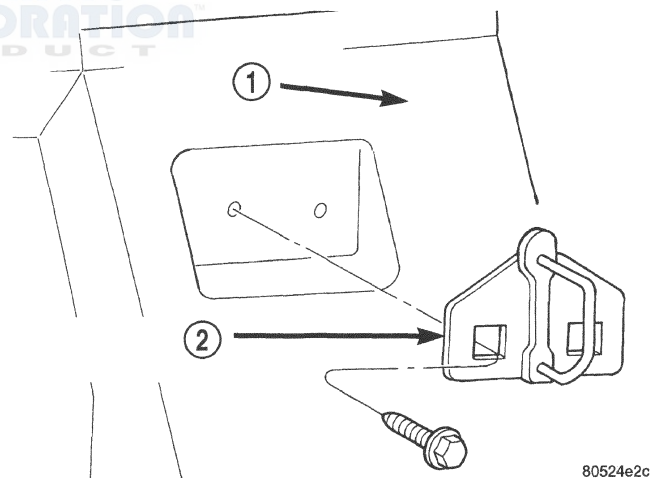
### INSTALLATION

- (1) Position decklid hinge to vehicle.
- (2) Loosely install bolts attaching decklid hinge to quarter panel.
- (3) Loosely install bolts attaching decklid hinge to decklid.
- (4) Align decklid hinge to marks made previously and tighten all fasteners.
- (5) Install gas support cylinder to decklid hinge.
- (6) Install caps at each end of gas support cylinder.
- (7) Verify fit of decklid to deck panel. Adjust as necessary.

## DECKLID LATCH STRIKER

### REMOVAL

- (1) Release decklid latch and open decklid.
- (2) Mark outline of decklid latch striker on rear closure panel to aid in installation.
- (3) Remove bolts attaching decklid latch striker to rear closure panel (Fig. 54).
- (4) Remove striker from vehicle.



**Fig. 54 Decklid Latch Striker**

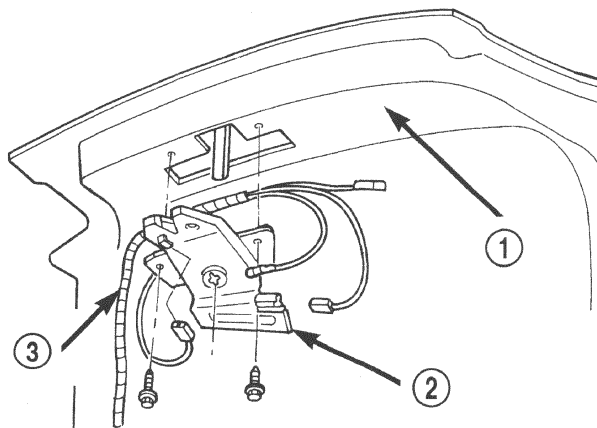
- 1 - REAR CLOSURE PANEL  
2 - TRUNK LATCH STRIKER

### INSTALLATION

- (1) Position striker in vehicle.
- (2) Loosely install bolts attaching decklid latch striker to rear closure panel.
- (3) Align decklid latch striker to marks made previously on rear closure panel and tighten bolts.
- (4) Verify fit of decklid to deck panel and operation of decklid latch. Adjust as necessary.

**REMOVAL AND INSTALLATION (Continued)****DECKLID LATCH****REMOVAL**

- (1) Release decklid latch and open decklid.
- (2) Mark outline of decklid latch on decklid to aid in installation.
- (3) Disconnect wire connectors to remote release solenoid, if so equipped (Fig. 55).
- (4) Remove bolts attaching decklid latch to decklid.
- (5) Remove decklid latch from vehicle.

**Fig. 55 Decklid Latch**

- 1 - TRUNK LID  
2 - TRUNK LATCH  
3 - WIRE HARNESS

**INSTALLATION**

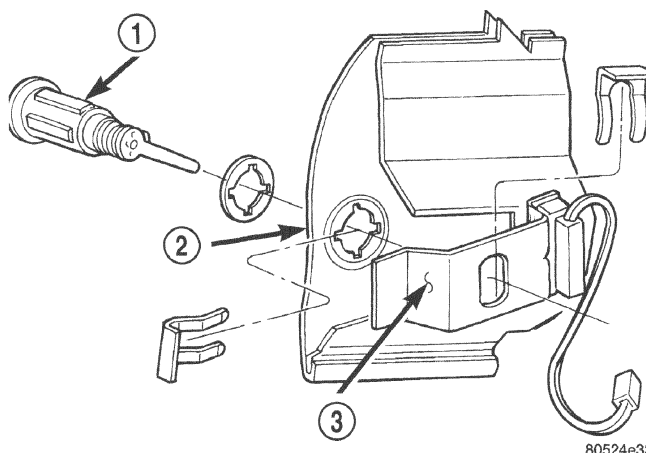
- (1) Position decklid latch on vehicle.
- (2) Loosely install bolts attaching decklid latch to decklid.
- (3) Align decklid latch to marks made previously on decklid and tighten bolts.
- (4) Connect wire connectors to remote release solenoid, if so equipped.
- (5) Verify fit of decklid to deck panel and decklid latch operation. Adjust as necessary.

**DECKLID LOCK CYLINDER****REMOVAL**

- (1) Release decklid latch and open decklid.
- (2) Remove decklid latch.
- (3) Remove clip attaching decklid lock cylinder to security alarm switch, if so equipped (Fig. 56).
- (4) Remove security alarm switch, if so equipped.
- (5) Remove clip attaching decklid lock cylinder to decklid.
- (6) Remove decklid lock cylinder from vehicle.

**INSTALLATION**

- (1) Position decklid lock cylinder on vehicle

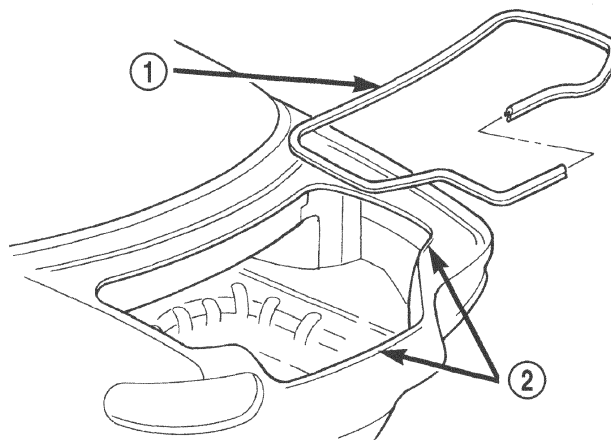
**Fig. 56 Decklid Lock Cylinder**

- 1 - TRUNK LOCK CYLINDER  
2 - TRUNK LID  
3 - DECKLID SECURITY ALARM SWITCH

- (2) Install clip holding decklid lock cylinder to decklid.
- (3) Install security alarm switch, if so equipped.
- (4) Install clip attaching decklid lock cylinder to security alarm switch, if so equipped.
- (5) Install decklid latch.

**DECKLID OPENING WEATHERSTRIP****REMOVAL**

- (1) Release decklid latch and open decklid.
- (2) Pull decklid opening weatherstrip from decklid opening flange (Fig. 57).
- (3) Remove decklid opening weatherstrip from vehicle.

**Fig. 57 Decklid Opening Weatherstrip**

- 1 - TRUNK OPENING WEATHERSTRIP  
2 - TRUNK OPENING FLANGE



## REMOVAL AND INSTALLATION (Continued)

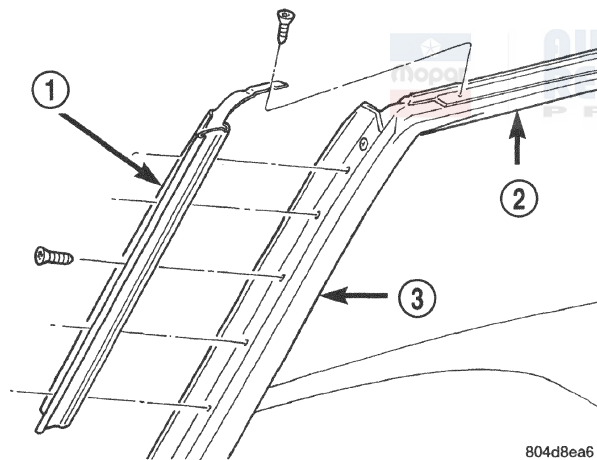
### INSTALLATION

- (1) Position decklid opening weatherstrip on vehicle.
- (2) Starting with one end of decklid opening weatherstrip over decklid latch striker, push weatherstrip onto decklid opening flange.
- (3) Verify that the ends of the decklid opening weatherstrip meet above the decklid latch striker.
- (4) Verify decklid operation and sealing.

### A-PILLAR WEATHERSTRIP RETAINER AND MOLDING

#### REMOVAL

- (1) Partially raise convertible top.
- (2) Remove header and A-pillar weatherstrip as necessary to gain access.
- (3) Remove screws holding A-pillar weatherstrip retainer to A-pillar (Fig. 58).
- (4) Remove retainer from vehicle.
- (5) Remove screws attaching A-pillar molding to A-pillar.
- (6) Remove A-pillar molding from vehicle.



**Fig. 58 A-Pillar Weatherstrip Retainer**

- 1 - A-PILLAR WEATHERSTRIP RETAINER  
2 - HEADER  
3 - A-PILLAR

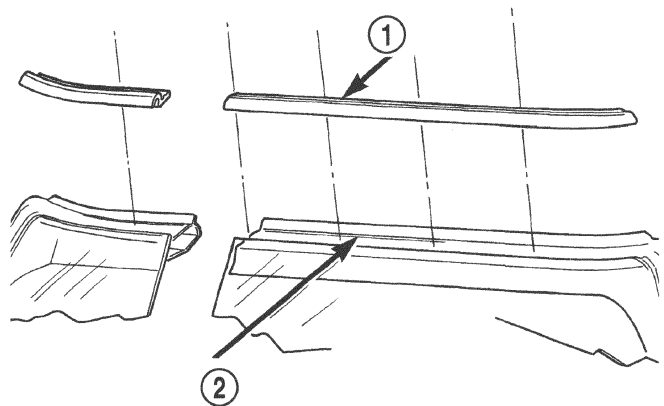
#### INSTALLATION

- (1) Clean A-pillar of any seal material residue.
- (2) Position A-pillar molding to vehicle.
- (3) Install screws attaching A-pillar molding to A-pillar.
- (4) Position A-pillar weatherstrip retainer on A-pillar.
- (5) Install screws attaching retainer to A-pillar. Install middle screw first and then work outward.
- (6) Install header and A-pillar weatherstrip.
- (7) Lower and secure convertible top.

### HEADER WEATHERSTRIP RETAINER/MOLDING

#### REMOVAL

- (1) Partially raise convertible top.
- (2) Remove header and A-pillar weatherstrip as necessary to gain access.
- (3) Remove screws attaching A-pillar weatherstrip retainer to header weatherstrip retainer.
- (4) Remove screws attaching header weatherstrip retainer to header panel (Fig. 59).
- (5) Remove retainer from vehicle.



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**Fig. 59 Header Weatherstrip Retainer**

- 1 - HEADER WEATHERSTRIP RETAINER  
2 - HEADER

#### INSTALLATION

- (1) Clean any residual seal material from header panel.
- (2) Position header weatherstrip retainer on vehicle.
- (3) Install screws attaching retainer to header panel. Install center screw first and then work outward.
- (4) Install screws attaching A-pillar weatherstrip retainer to header retainer.
- (5) Install L foam in upper corner starting at upper screw on the A-pillar retainer.
- (6) Install L foam in upper corner starting at upper screw on A-pillar.
- (7) Install header and A-pillar weatherstrip.
- (8) Lower and secure convertible top.

### HEADER/A-PILLAR WEATHERSTRIP

#### REMOVAL

- (1) Partially raise convertible top.
- (2) Remove inside rear view mirror.
- (3) Remove sun visors.
- (4) Remove header trim panel.
- (5) Remove both door sill trim panels.



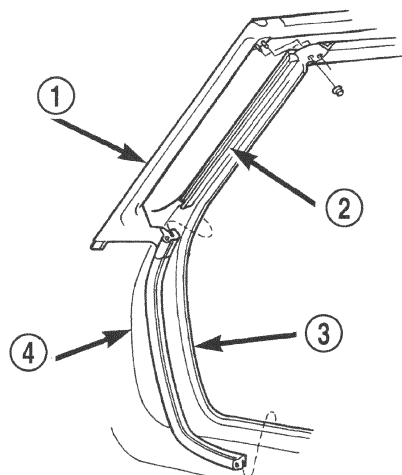
**REMOVAL AND INSTALLATION (Continued)**

(6) Remove nuts holding header and A-pillar weatherstrip at upper corners of windshield (Fig. 60).

(7) Remove push in fasteners at lower corners of windshield holding weatherstrip to A-pillar.

(8) Remove header and A-pillar weatherstrip from vehicle.

(9) Clean any residual seal material from header panel.



**Fig. 60 Header/A-Pillar Weatherstrip**

- 1 - HEADER/A-PILLAR WEATHERSTRIP
- 2 - A-PILLAR WEATHERSTRIP RETAINER
- 3 - DOOR OPENING FLANGE
- 4 - FENDER

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**INSTALLATION**

**CAUTION:** Ensure that the butyl patch and butyl rope at each corner of the windshield is present and in good condition (Fig. 61). The butyl is critical for the water management system. Replace as necessary.

(1) Install new L foam starting at upper screw on A-pillar retainer.

(2) Install new L foam starting at upper screw on A-pillar retainer (Fig. 62).

(3) Position header and A-pillar weatherstrip on vehicle.

(4) Secure weatherstrip into retainers at header and A-pillar.

(5) Install nuts at upper corners of windshield.

(6) Install push in fasteners at lower corners of windshield.

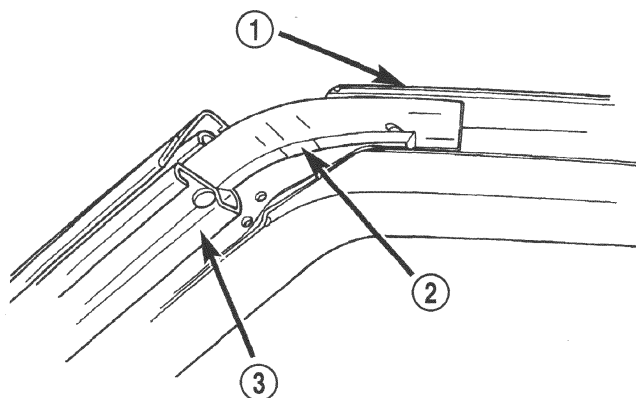
(7) Install door sill trim panels.

(8) Install header trim panel.

(9) Install sun visors.

(10) Install inside rear view mirror.

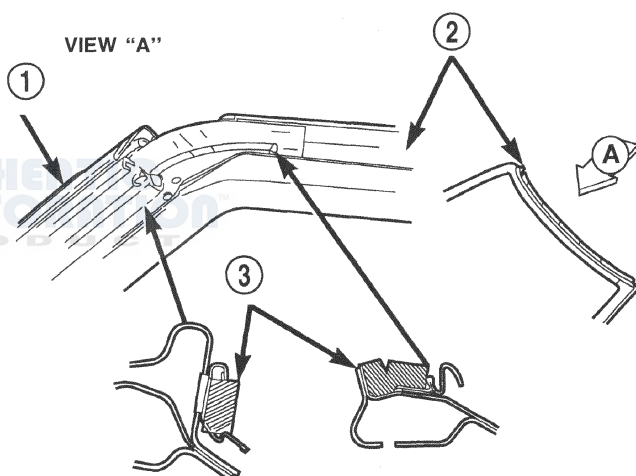
(11) Lower and secure convertible top.



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**Fig. 61 Butyl Patch and L - FOAM**

- 1 - HEADER WEATHERSTRIP RETAINER
- 2 - L-SHAPE FOAM ROPE
- 3 - A-PILLAR WEATHERSTRIP RETAINER



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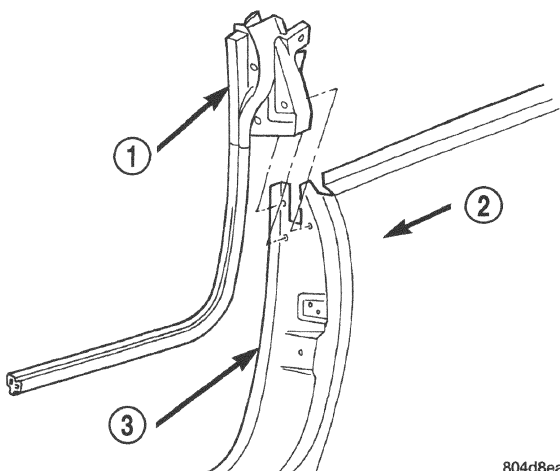
**Fig. 62 L Shape Foam Location**

- 1 - A-PILLAR
- 2 - HEADER
- 3 - L SHAPE FOAM

**QUARTER PANEL WEATHERSTRIP****REMOVAL**

- (1) Remove door sill trim panel.
- (2) Remove push in fasteners holding weatherstrip to B-pillar.
- (3) Remove weatherstrip from door opening flange.
- (4) Remove quarter panel weatherstrip from vehicle (Fig. 63).

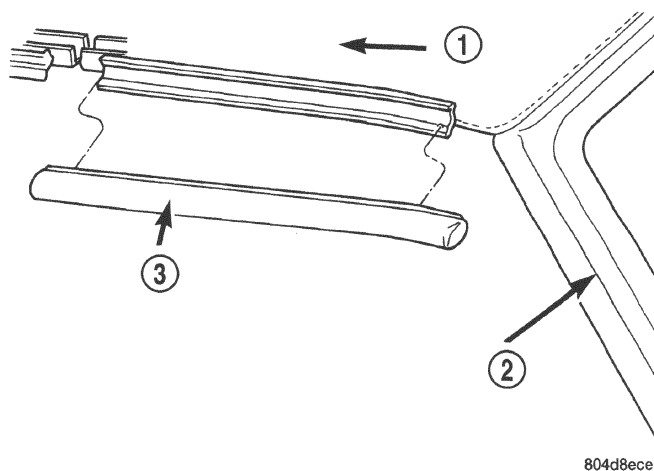
## REMOVAL AND INSTALLATION (Continued)



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**Fig. 63 Quarter Panel Weatherstrip**

- 1 - QUARTER PANEL WEATHERSTRIP
- 2 - QUARTER PANEL
- 3 - DOOR OPENING FLANGE



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**Fig. 64 Front Side Rail Weatherstrip**

- 1 - CONVERTIBLE TOP
- 2 - A-PILLAR
- 3 - FRONT SIDE RAIL WEATHERSTRIP

## INSTALLATION

- (1) Position panel weatherstrip onto vehicle.
- (2) Install weatherstrip to door opening flange.
- (3) Install push in fasteners attaching weatherstrip to B-pillar.
- (4) Install door sill trim panel.

## SIDE RAIL WEATHERSTRIPS

### FRONT

#### REMOVAL

- (1) Partially raise convertible top.
- (2) Remove push in fasteners attaching weatherstrip to retainer.
- (3) Remove weatherstrip from vehicle (Fig. 64).

#### INSTALLATION

- (1) Position weatherstrip on vehicle.
- (2) Install push in fasteners into retainer channel, aligning embossment on back side of weatherstrip to corner of retainer.
- (3) Lower convertible top.
- (4) Secure convertible top.

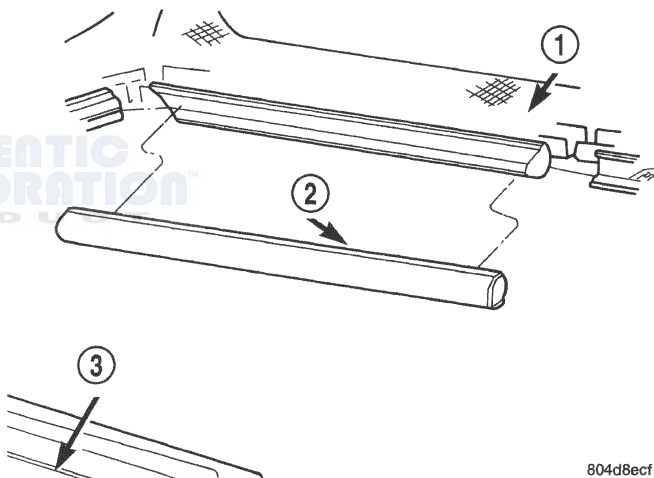
### CENTER

#### REMOVAL

- (1) Partially raise convertible top.
- (2) Remove push in fasteners attaching weatherstrip to retainer.
- (3) Remove weatherstrip from vehicle (Fig. 65).

#### INSTALLATION

- (1) Position weatherstrip on vehicle.



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**Fig. 65 Center Side Rail Weatherstrip**

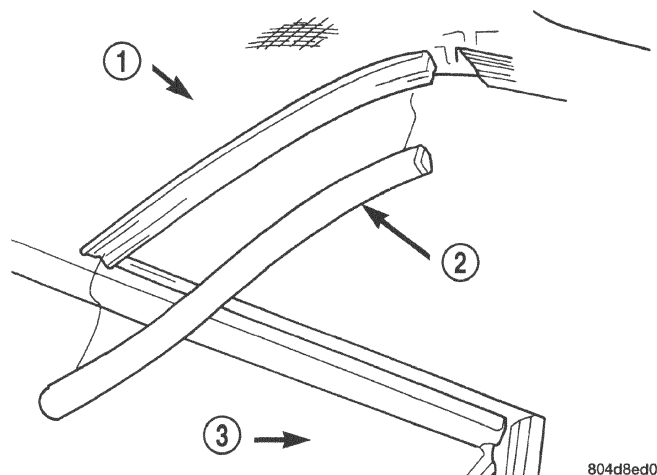
- 1 - CONVERTIBLE TOP
- 2 - CENTER SIDE RAIL WEATHERSTRIP
- 3 - QUARTER PANEL

- (2) Install push in fasteners into retainer channel, aligning embossment on back side of weatherstrip to corner of retainer.
- (3) Lower convertible top.
- (4) Secure convertible top.

### REAR

#### REMOVAL

- (1) Partially raise convertible top.
- (2) Remove push in fasteners attaching weatherstrip to retainer.
- (3) Separate weatherstrip from vehicle (Fig. 66).

**REMOVAL AND INSTALLATION (Continued)****Fig. 66 Rear Side Rail Weatherstrip**

- 1 - CONVERTIBLE TOP  
 2 - REAR SIDE RAIL WEATHERSTRIP  
 3 - QUARTER PANEL

**INSTALLATION**

- (1) Position weatherstrip on vehicle.
- (2) Install push in fasteners into retainer channel, aligning embossment on back side of weatherstrip to corner of retainer.
- (3) Push weatherstrip into retainer channel, aligning embossment on backside of weatherstrip to corner of retainer.
- (4) Lower convertible top.
- (5) Secure convertible top.

**A-PILLAR TRIM PANEL****REMOVAL**

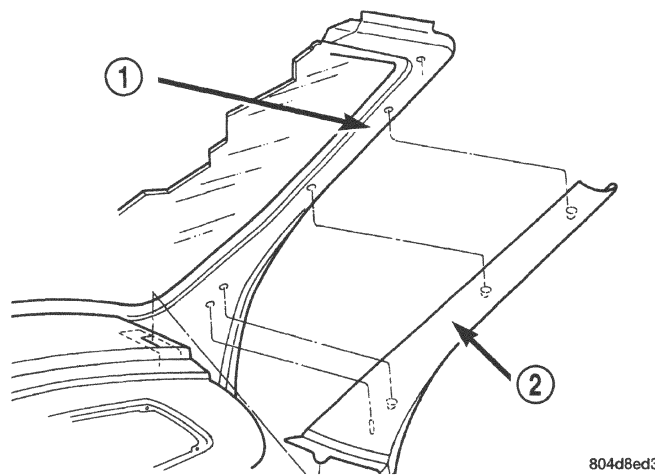
- (1) Disengage clips attaching A-pillar trim panel to A-pillar.
- (2) Remove trim panel from vehicle (Fig. 67).

**INSTALLATION**

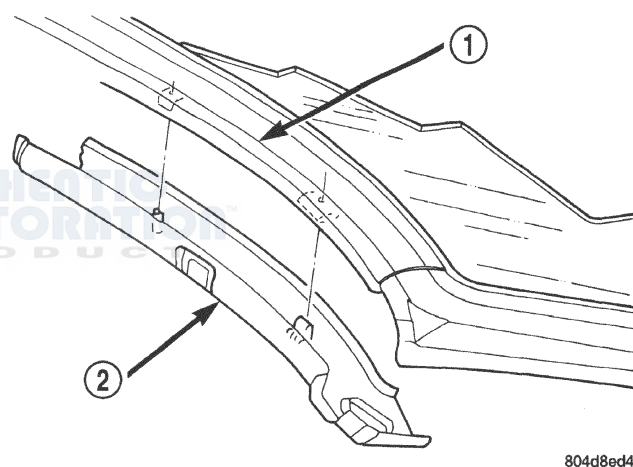
- (1) Position trim panel near A-pillar.
- (2) Align locating pins on back side of trim panel to holes in A-pillar.
- (3) Press clips on A-pillar trim panel into slots in A-pillar.

**HEADER TRIM PANEL - RIGHT OR LEFT****REMOVAL**

- (1) Remove sun visor.
- (2) Remove inside rear view mirror, right side only.
- (3) Disengage clip attaching header trim panel to header panel.
- (4) Remove header trim panel from vehicle (Fig. 68).

**Fig. 67 A-Pillar Trim Panel**

- 1 - A-PILLAR  
 2 - A-PILLAR TRIM PANEL

**Fig. 68 Header Trim Panel**

- 1 - HEADER  
 2 - HEADER TRIM PANEL

**INSTALLATION**

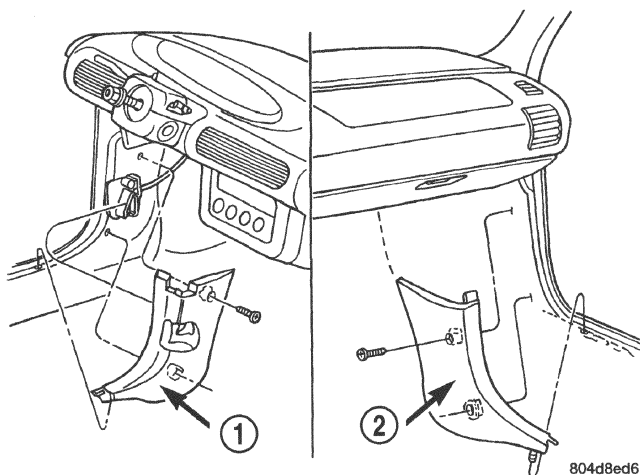
- (1) Position header trim panel on vehicle.
- (2) Align locating pins on back side of trim panel to holes in header panel.
- (3) Engage clip on trim panel to slots in header panel.
- (4) Install inside rear view mirror.
- (5) Install sun visor.

**COWL TRIM PANEL****REMOVAL**

- (1) Remove door sill trim panel.
- (2) Remove screws attaching cowl trim panel to inner cowl panel.

## REMOVAL AND INSTALLATION (Continued)

- (3) Remove cowl trim panel from vehicle (Fig. 69).



**Fig. 69 Cowl Trim Panel**

- 1 - LEFT COWL TRIM PANEL  
2 - RIGHT COWL TRIM PANEL

## INSTALLATION

- (1) Position cowl trim panel to vehicle.
- (2) Install screws attaching cowl trim panel to inner cowl panel.
- (3) Install door sill trim panel.

## DOOR SILL TRIM PANEL

### REMOVAL

- (1) Using a fork type prying tool, disengage clips holding door sill trim panel to door sill (Fig. 70).
- (2) Starting at one end of sill trim panel, pull upward on sill trim panel in order to disengage clips attaching sill trim panel to door opening flange.
- (3) Remove door sill trim panel from vehicle.

### INSTALLATION

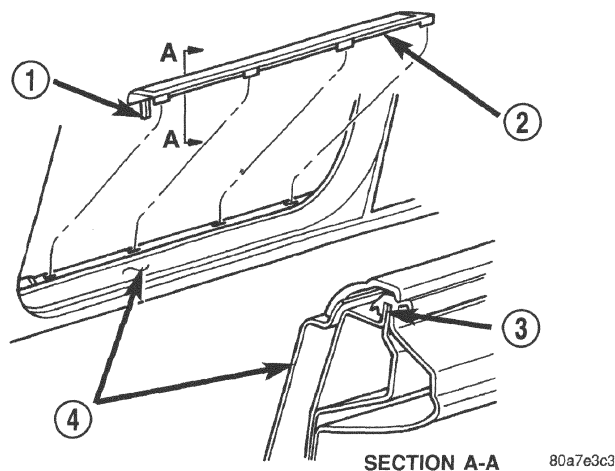
- (1) Position door sill trim panel on vehicle.
- (2) Align locating rib to rest against cowl trim panel.
- (3) Engage clips on sill trim panel to door opening flange.

**NOTE:** Check that header/A-pillar and quarter panel weatherstrips are properly positioned. Incorrect positioning will interfere with clip engagement to door opening flange and damage door sill trim panel.

- (4) Engage clips attaching sill trim panel to door sill.

## FRONT SEAT BELT RETRACTOR

Inspect the condition of the shoulder belt and lap belt. Replace any belt that is cut, frayed, torn, or



**Fig. 70 Door Sill Trim Panel**

- 1 - LOCATING TAB  
2 - DOOR SILL TRIM PANEL  
3 - DOOR OPENING FLANGE  
4 - DOOR SILL

damaged in any way. Also, replace the shoulder belt if the retractor is either damaged or inoperative.

### REMOVAL

- (1) Remove seat from vehicle.

**NOTE:** The torque prevailing nut used to secure the lower seat belt anchor is not reusable. Verify availability prior to proceeding.

- (2) Remove seat back cover to gain access to seat belt retractor. Refer to procedure found in this section.
- (3) Remove seat belt retractor cover.
- (4) Remove and discard bolts attaching seat belt retractor to seat frame.

**CAUTION:** Do not reuse the bolts attaching the seat belt retractor to the seat frame.

- (5) Remove seat belt retractor from seat frame.
- (6) Disconnect wire connector from seat belt retractor.

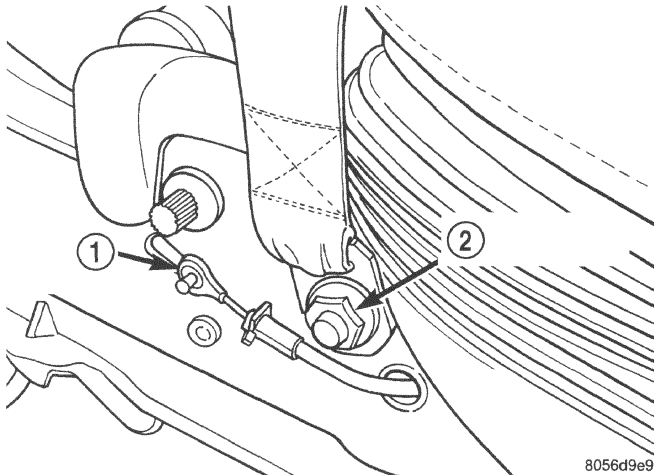
### INSTALLATION

- (1) Position seat belt retractor to seat frame.
- (2) Connect wire connector to seat belt retractor.
- (3) Install new bolts to hold seat belt retractor to seat frame.

**NOTE:** The tighten the retractor bolts to 16.2 N-m (12 ft. lbs.) torque.

- (4) Install seat belt retractor cover.
- (5) Install seat cover. Refer to procedure found in this section.



**REMOVAL AND INSTALLATION (Continued)****Fig. 71 Lower Seat Belt Anchor And Recliner Cable**

- 1 - RECLINER CABLE  
2 - LOWER SEAT BELT ANCHOR

(6) Attach lower seat belt anchor to bolt on seat adjuster.

(7) Verify that seat belt is routed such that it will not be twisted when engaged to the seat belt buckle.

(8) Verify that a minimum of three threads extend beyond the lower seat belt anchor nut and that the lower seat belt anchor swivels freely. If both conditions are not found, check that the bolt is fully engaged to the seat adjuster.

(9) Install seat in vehicle.

**CAUTION:** Failure to follow proper installation procedure may result in the seat track latch pins not being synchronized.

**FRONT SEAT BELT BUCKLE****REMOVAL**

**NOTE:** The torque prevailing nut holding the front seat belt buckle to the seat adjuster is not reusable. Verify availability prior to proceeding.

(1) Remove nut holding seat belt buckle to seat adjuster. Discard nut.

(2) Remove seat belt buckle from seat.

**INSTALLATION**

(1) Verify that the black spacer washer is properly installed over the shoulder of the weld nut on the seat adjuster.

(2) Install seat belt buckle to bolt on seat adjuster.

(3) Verify that the seat belt buckle is sitting on the shoulder of the weld nut on the seat adjuster.

(4) Install nut to hold seat belt buckle to seat adjuster.

**NOTE:** The tighten the seat belt buckle nut is 45 N-m (33 ft. lbs.) torque.

(5) Verify that a minimum of three threads extend beyond the seat belt buckle nut. If not, check that the bolt is fully engaged to the seat adjuster.

**FLOOR CONSOLE****REMOVAL**

(1) Raise parking brake lever as high as possible.

(2) Move transmission shifter to neutral position.

(3) Loosen set screw on front of shifter knob and remove shift lever knob.

(4) Remove lighted transmission range indicator letter bezel (Fig. 72).

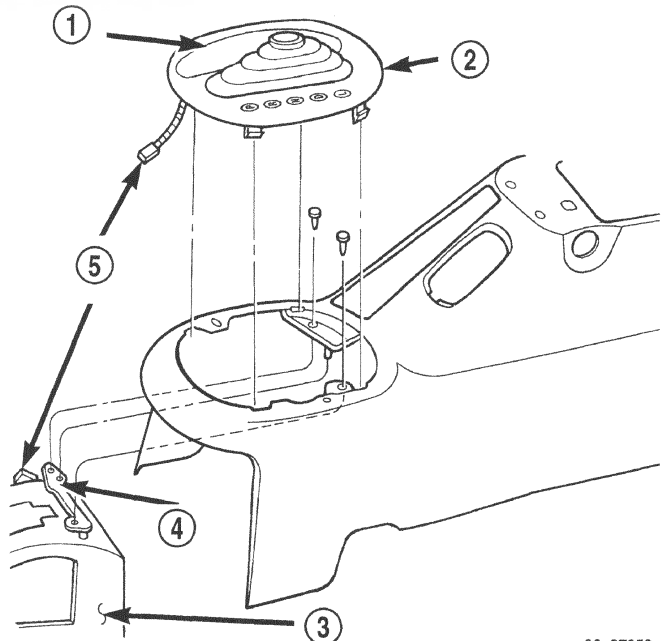
(5) Disconnect transmission range indicator bezel wire connector at the shifter mechanism.

(6) Remove screws, next to floor shifter and in console storage compartment, attaching floor console to brackets on floor pan.

(7) Disconnect wire connector for floor console accessories at floor pan.

(8) Remove console from vehicle.

**NOTE:** The grip portion of the parking brake lever will only fit through the wider lower portion of the slot in the floor console.

**Fig. 72 Transmission Range Indicator Bezel**

- 1 - BEZEL BOOT  
2 - PRNDL BEZEL  
3 - SHIFTER MECHANISM  
4 - LOCATOR PIN  
5 - WIRING CONNECTOR

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## REMOVAL AND INSTALLATION (Continued)

### INSTALLATION

- (1) Position console in vehicle.
- (2) Connect wire connector for floor console accessories at floor pan.
- (3) Verify that the rear locator pin on the bottom of the storage bin is engaged to the slot in the body bracket and the front pin is engaged to the shift mechanism (Fig. 72).
- (4) Install screws, next to floor shifter and in console storage compartment, holding floor console to brackets on floor pan.
- (5) Connect transmission range indicator bezel wire connector on shifter mechanism.
- (6) Install lighted transmission range indicator letter bezel.
- (7) Install shift lever knob and tighten set screw on front of shifter knob.

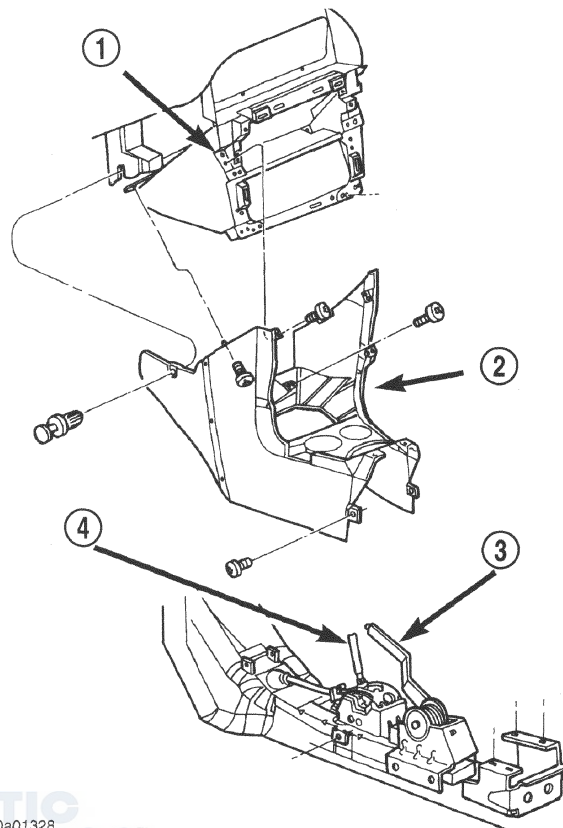
### FORWARD INSTRUMENT PANEL CONSOLE

#### REMOVAL

- (1) Remove floor console.
- (2) Remove instrument panel cluster hood. Refer to Group 8E, Instrument Panel and Systems, for proper procedure.
- (3) Remove instrument panel center bezel.
- (4) Remove left knee bolster.
- (5) Release glove box door catches and allow to hang downward.
- (6) Remove screws holding storage bin to forward instrument panel console (Fig. 73).
- (7) Remove storage bin from forward instrument panel console.
- (8) Remove screws holding forward instrument console to shifter mounting bracket.
- (9) Remove screws attaching forward instrument panel console to instrument panel at sides of storage bin area.
- (10) Remove screws attaching forward instrument panel console to instrument panel support braces.
- (11) Remove forward instrument panel console from vehicle.

#### INSTALLATION

- (1) Position forward instrument panel console to vehicle.
- (2) Install screws attaching forward instrument panel console to instrument panel support braces.
- (3) Install screws attaching forward instrument panel console to instrument panel at sides of storage bin area.
- (4) Install screws attaching forward instrument panel console to shifter mounting bracket.
- (5) Install storage bin from forward instrument panel console.



**Fig. 73 Forward Instrument Panel Console**

- 1 - INSTRUMENT PANEL
- 2 - FORWARD INSTRUMENT PANEL CONSOLE
- 3 - PARK BRAKE
- 4 - GEAR SHIFTER

- (6) Install screws attaching storage bin to forward instrument panel console.
- (7) Release glove box door catches and allow to hang downward.
- (8) Install left knee bolster.
- (9) Install instrument panel center bezel.
- (10) Install instrument panel cluster hood.
- (11) Install floor console.

### QUARTER TRIM PANEL

#### REMOVAL

- (1) Lower convertible top.
- (2) Remove rear seat cushion and rear seat back.
- (3) Remove door sill trim panel.
- (4) Remove push-in fastener attaching quarter trim panel to door sill panel.
- (5) Remove speaker grille (Fig. 74).
- (6) Remove vertical screws and inboard screw attaching quarter trim panel to inner quarter panel (Fig. 75).
- (7) Remove screws attaching quarter trim panel to inner quarter panel through the speaker opening.

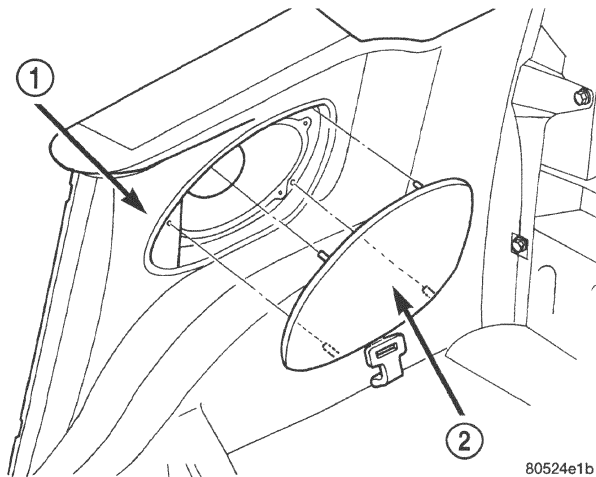
**REMOVAL AND INSTALLATION (Continued)**

(8) Remove screws attaching quarter trim panel to inner quarter panel at rear of trim panel.

(9) Remove push-in fasteners attaching quarter trim panel to inner quarter panel at front of trim panel.

(10) Pull trim panel from inner quarter panel and disconnect speaker wiring connector.

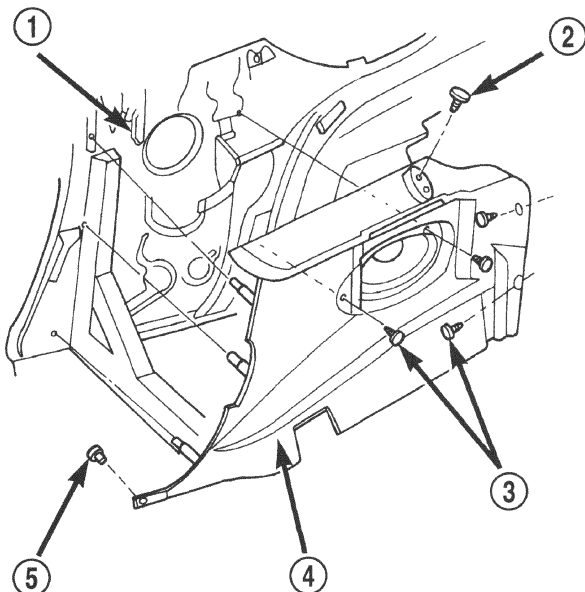
(11) Remove quarter trim panel from vehicle.



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**Fig. 74 Speaker Grille**

- 1 - QUARTER TRIM PANEL  
2 - SPEAKER GRILLE



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**Fig. 75 Quarter Trim Panel**

- 1 - INNER QUARTER PANEL  
2 - INBOARD VELCRO SCREW  
3 - SCREWS  
4 - QUARTER TRIM PANEL  
5 - PUSH-IN FASTENER

**INSTALLATION**

(1) Position quarter trim panel on vehicle.

(2) Connect speaker wiring connector.

(3) Install push-in fasteners attaching quarter trim panel to inner quarter panel at front of trim panel.

(4) Install screws attaching quarter trim panel to inner quarter panel through the speaker opening.

(5) Install vertical screws and inboard screw attaching quarter trim panel to inner quarter panel.

(6) Install screws attaching quarter trim panel to inner quarter panel at rear of trim panel.

(7) Install push-in fastener attaching quarter trim panel to door sill panel.

(8) Install door sill trim panel.

(9) Install speaker grille.

(10) Install rear seat cushion and rear seat back.

**REAR OUTER SEAT BELT AND RETRACTOR****REMOVAL**

(1) Remove rear seat cushion.

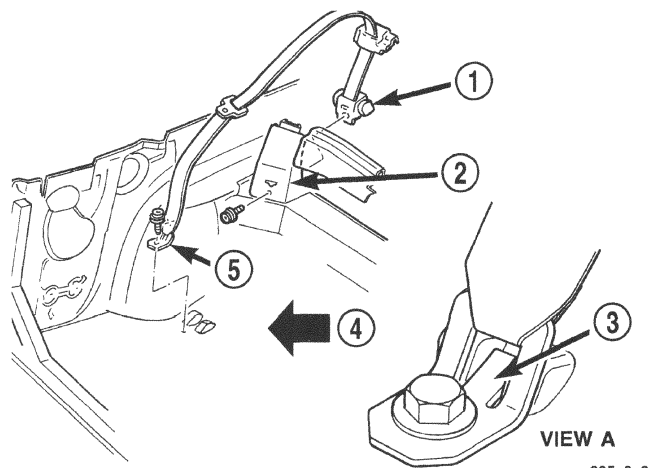
(2) Remove rear seat back.

(3) Remove quarter trim panel.

(4) Remove bolt attaching seat belt anchor to floor pan (Fig. 76).

(5) Remove bolt attaching seat belt retractor to rear seat support assembly.

(6) Remove seat belt and retractor assembly from vehicle.



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**Fig. 76 Rear Outer Seat Belt And Retractor**

- 1 - SEAT BELT RETRACTOR  
2 - REAR SEAT SUPPORT  
3 - TAB  
4 - A  
5 - LOWER ANCHOR



## REMOVAL AND INSTALLATION (Continued)

### INSTALLATION

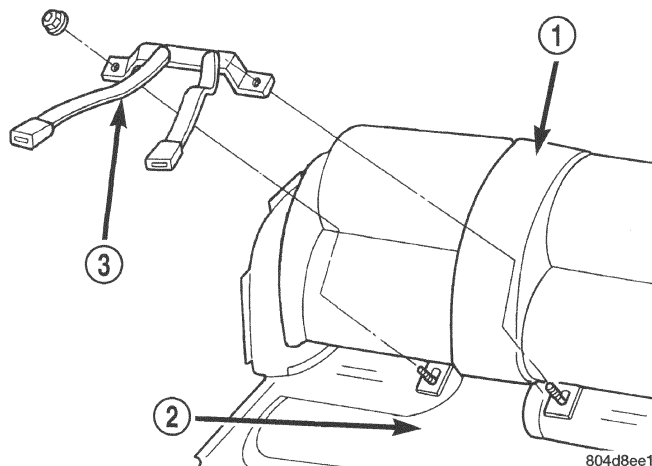
- (1) Position seat belt and retractor assembly to rear seat support assembly.
- (2) Engage hook on seat belt retractor to slot in rear seat support assembly.
- (3) Install bolt attaching seat belt retractor to rear seat support assembly.
- (4) Route seat belt through channel and snap bezel onto top of channel.
- (5) Install bolt attaching seat belt anchor to floor pan.
- (6) Verify that seat belt is not twisted when engaged to seat belt buckle and that the tab on the lower seat belt anchor is between the formations on the floor pan (Fig. 76).
- (7) Install quarter trim panel.
- (8) Install rear seat back.
- (9) Install rear seat cushion.

**NOTE:** Tighten both seat belt fasteners to 40 N·m (350 in. lbs.) torque.

### REAR INNER SEAT BELT ASSEMBLY

#### REMOVAL

- (1) Remove rear seat cushion.
- (2) Remove nuts holding seat belt assembly to floor pan.
- (3) Remove rear inner seat belt assembly (Fig. 77).



**Fig. 77 Rear Inner Seat Belt Assembly**

- 1 - REAR SEAT BACK
- 2 - FLOOR PAN
- 3 - INNER SEAT BELT ASSEMBLY

#### INSTALLATION

- (1) Position rear inner seat belt assembly onto studs on floor pan.
- (2) Install nuts holding seat belt assembly to floor pan.

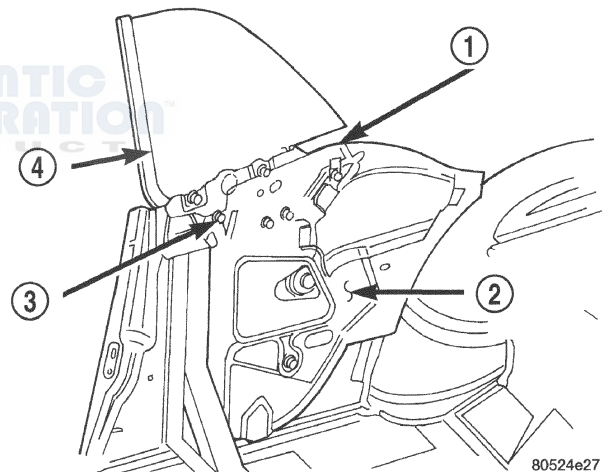
- (3) Install rear seat cushion.

**NOTE:** Torque specification for rear inner seat belt assembly is 40 N·m (350 in. lbs.).

### QUARTER WINDOW MODULE

#### REMOVAL

- (1) Raise quarter glass to full up position, if possible, to aid in removal.
- (2) Remove quarter trim panel.
- (3) Partially lower convertible top.
- (4) Remove the fasteners attaching the glass to the lift channel of the quarter window glass module (Fig. 78).
- (5) Loosen the latch plate hook nut and remove the glass from the vehicle.
- (6) Remove screws attaching quarter panel weatherstrip assembly to the outer quarter panel.
- (7) Loosen upper deck molding.
- (8) Pull upward at one end of the outer belt weatherstrip assembly to remove from vehicle.



**Fig. 78 Quarter Window Glass**

- 1 - QUARTER GLASS LIFT CHANNEL
- 2 - INNER QUARTER PANEL
- 3 - LATCH PLATE HOOK NUT
- 4 - QUARTER GLASS

#### INSTALLATION

- (1) Position the quarter panel outer belt weatherstrip assembly on vehicle.
- (2) Push the outer belt weatherstrip assembly downward until the weatherstrip assembly is fully seated.
- (3) Install the screws attaching the outer belt weatherstrip assembly to outer panel.
- (4) Tighten the upper belt molding fasteners.
- (5) Position the glass in the vehicle.



**REMOVAL AND INSTALLATION (Continued)**

(6) Loosely install the fasteners attaching the glass to the lift channel of the quarter window module.

(7) Tighten the latch plate hook nut.

(8) Adjust the quarter glass as necessary. Refer to the Quarter Glass Adjustment procedures.

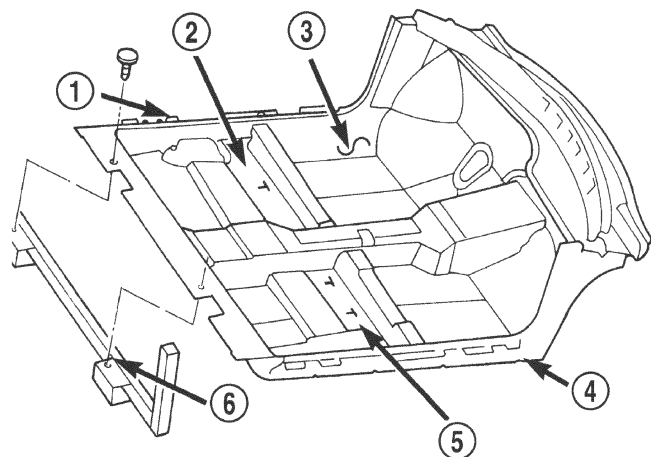
(9) Lift quarter window module upward and out opening at top of quarter panel.

(10) Install quarter trim panel.

(11) Raise and secure convertible top.

**CARPET****REMOVAL**

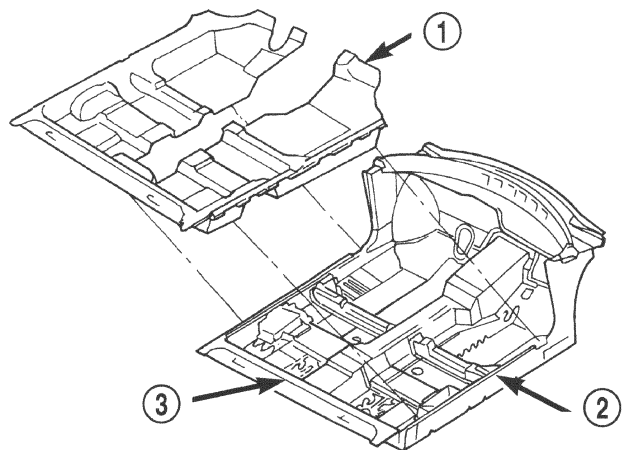
- (1) Lower convertible top to full down position.
- (2) Remove front seats.
- (3) Remove rear seat cushion.
- (4) Remove floor console and forward instrument panel console.
- (5) Remove door sill trim panels.
- (6) Remove cowl trim panels.
- (7) Remove quarter trim panels.
- (8) Remove amplifier on passenger side of floor pan, if so equipped.
- (9) Remove wiring troughs holding carpet at outboard ends of rear seat crossmember.
- (10) Remove push-in fasteners from rear of carpet attaching carpet to rear seat crossmember (Fig. 79).
- (11) Remove plastic sill retainers from metal clips along door sill panel.
- (12) Remove carpet from vehicle (Fig. 79).



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**Fig. 79 Carpet Fasteners**

- 1 - DOOR SILL
- 2 - SEAT WIRING SLIT
- 3 - CARPET
- 4 - DOOR SILL
- 5 - AMPLIFIER WIRING SLIT
- 6 - REAR SEAT CROSSMEMBER



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**Fig. 80 Carpet**

- 1 - CARPET
- 2 - DOOR SILL
- 3 - REAR SEAT CROSSMEMBER

**INSTALLATION**

- (1) Position carpet in vehicle.
- (2) Install push-in fasteners from rear of carpet holding carpet to rear seat crossmember.
- (3) Feed wiring connectors for the seats and amplifier, if equipped, through slits in carpet.
- (4) Install plastic sill retainers in metal clips along door sill panel.
- (5) Install wiring troughs attaching carpet at outboard ends of rear seat crossmember.
- (6) Install amplifier on passenger side of floor pan, if so equipped.
- (7) Install quarter trim panels.
- (8) Install cowl trim panels.
- (9) Install door sill trim panels.
- (10) Install floor console and forward instrument panel console.
- (11) Install rear seat cushion.
- (12) Install front seats.
- (13) Raise and secure convertible top.

**QUARTER PANEL OUTER BELT WEATHERSTRIP/MOLDING****REMOVAL**

- (1) Lower convertible top to midway position.
- (2) Lower quarter glass to full down position.
- (3) Remove quarter trim panel.
- (4) Remove screws attaching quarter panel outer belt weatherstrip/molding to outer quarter panel.
- (5) Loosen appropriate side of upper deck molding.
- (6) Pull upward at one end of outer belt weatherstrip to separate from vehicle.
- (7) Remove outer belt weatherstrip from vehicle.

## REMOVAL AND INSTALLATION (Continued)

### INSTALLATION

- (1) Position quarter panel outer belt weatherstrip/molding on vehicle.
- (2) Push outer belt weatherstrip/molding downward until weatherstrip/molding is fully seated.
- (3) Install screws attaching outer belt weatherstrip to outer quarter panel.
- (4) Tighten fasteners for upper belt molding.
- (5) Install quarter trim panel.
- (6) Raise and secure convertible top.

### UPPER DECK MOLDING

#### REMOVAL

- (1) Lower convertible top to midway position.
- (2) Remove screws attaching upper deck molding to rear deck panel above convertible top rear attachment.
- (3) Open decklid.
- (4) Remove screws attaching upper deck molding to rear deck panel inside decklid water trough.
- (5) Disconnect wire connector for CHMSL.
- (6) Remove upper deck molding from vehicle.

#### INSTALLATION

- (1) Position upper deck molding on vehicle.
- (2) Connect wire connector for CHMSL.
- (3) Install screws attaching upper deck molding to rear deck panel inside decklid water trough.
- (4) Install screws attaching upper deck molding to rear deck panel above convertible top rear attachment.
- (5) Raise and secure convertible top.

### SUN VISOR

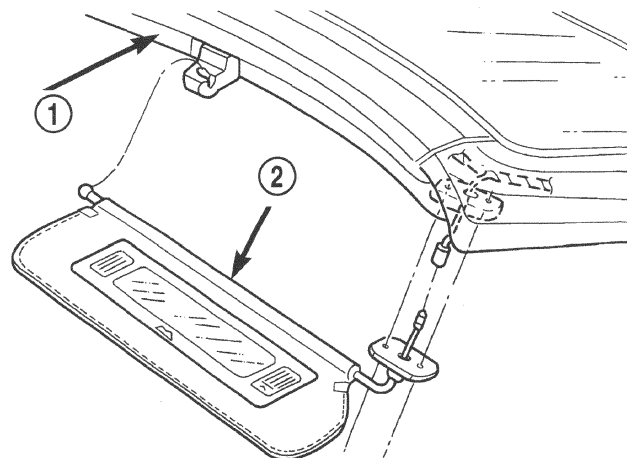
All vehicles with driver and passenger side airbags must have a colored coded five Bullet point airbag warning label applied to the sun visor, verify label availability and ensure the label is installed.

#### REMOVAL

- (1) Disengage sun visor from sun visor support.
- (2) Remove screws holding sun visor to header panel.
- (3) Disconnect lighted vanity mirror and universal garage door opener wiring, if so equipped.
- (4) Separate sun visor from vehicle (Fig. 81).

#### INSTALLATION

- (1) Position sun visor to vehicle.
- (2) Connect lighted vanity mirror and universal garage door opener wiring, if so equipped.
- (3) Install screws holding sun visor to header panel.
- (4) Engage sun visor to sun visor support.



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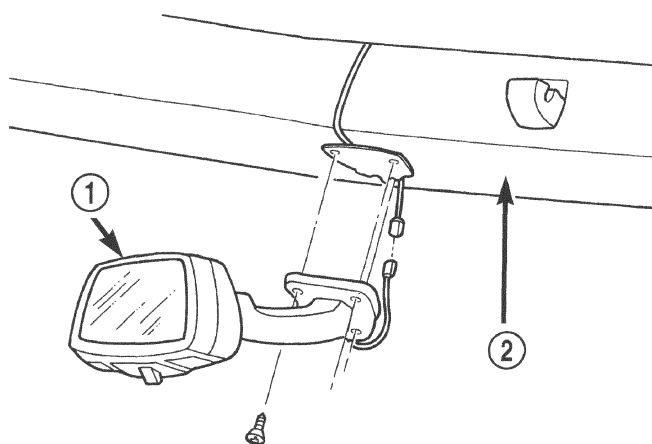
**Fig. 81 Sun Visor**

- 1 - HEADER PANEL  
2 - SUN VISOR

### INSIDE REAR VIEW MIRROR

#### REMOVAL

- (1) Remove screws attaching inside rear view mirror to header panel.
- (2) Disconnect wire connector to rear view mirror, if so equipped.
- (3) Remove rear view mirror from vehicle (Fig. 82).



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**Fig. 82 Inside Rear View Mirror**

- 1 - INSIDE REAR VIEW MIRROR  
2 - HEADER PANEL

#### INSTALLATION

- (1) Position inside rear view mirror to vehicle.
- (2) Connect wire connector to rear view mirror, if so equipped.
- (3) Install screws attaching rear view mirror to header panel.

## ADJUSTMENTS

### FRONT DOOR GLASS ADJUSTMENT

**NOTE:** Verify that the door is properly adjusted to the body prior to adjusting the door glass.

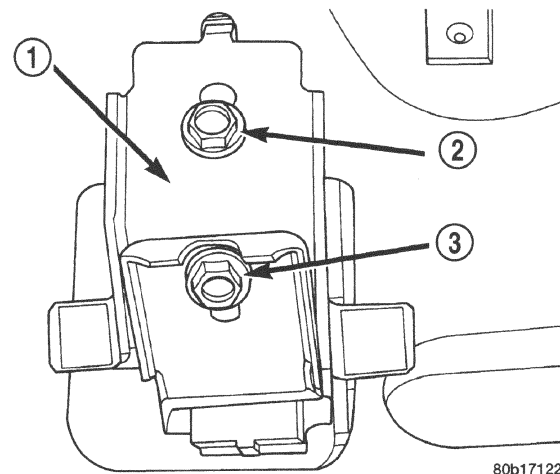
**NOTE:** Lower quarter glass to the full down position while making door glass adjustments, unless otherwise instructed.

### UP-STOP ADJUSTMENTS

- (1) Remove door trim panel.
- (2) Remove water shield as necessary to gain access to adjuster.
- (3) Loosen up stop nut (Fig. 83) and bolt (Fig. 84).
- (4) Remove weatherstrip from location to be adjusted.

**NOTE:** Remove only one weatherstrip section at a time or the glass to weatherstrip retainer measurements will not be accurate.

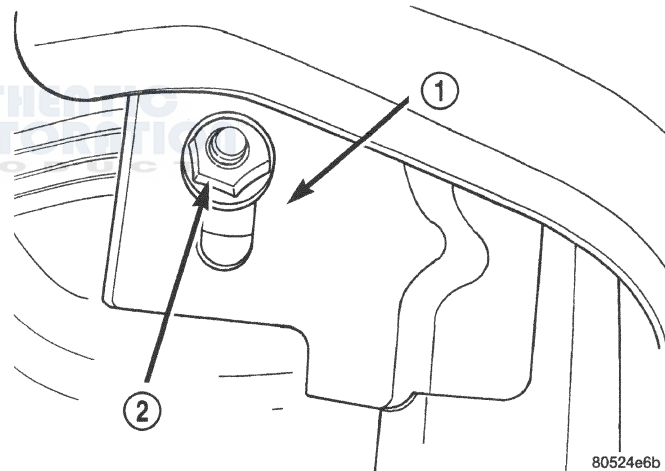
- (5) Close door and raise door glass.
- (6) Slide up stop to achieve proper glass to weatherstrip retainer gap. Refer to Front Door Glass Adjustment Table.
- (7) Tighten all fasteners.
- (8) Verify that forward up stop fully contacts hook on glass. Adjust contact bolt on forward up stop as necessary.



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**Fig. 83 Forward Up Stop Adjustment**

- 1 - FORWARD UPSTOP  
2 - ADJUSTMENT BOLT  
3 - CONTACT BOLT



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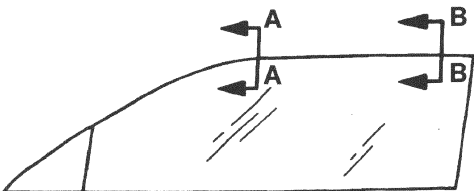
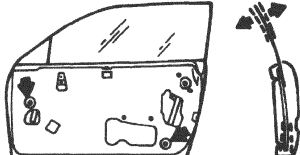
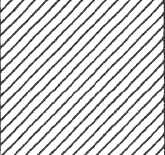
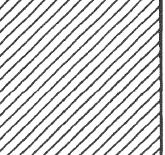
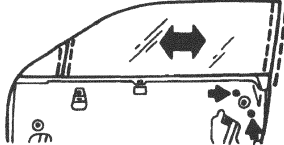
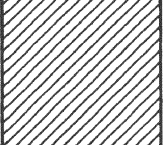
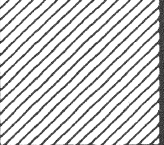


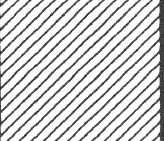
**Fig. 84 Rear Up Stop Adjustment**

- 1 - REAR UPSTOP  
2 - UPSTOP ADJUSTMENT NUT



## ADJUSTMENTS (Continued)

### FRONT DOOR GLASS ADJUSTMENT SPECIFICATIONS

			MEASUREMENT LOCATIONS AND THEIR VALUES			
			SECTION A-A		SECTION B-B	
			W	X	Y	Z
SEQUENCE	ADJUSTMENT		W	X	Y	Z
1	IN/OUT			20.0mm ±2mm		20.0mm ±2mm
2	FORWARD/ REARWARD		10.0mm ±2mm		10.0mm ±2mm	
	UP/DOWN		10.0mm ±2mm		10.0mm ±2mm	

**NOTE:** Forward / Rearward and Up/Down adjustment are to be made at the same time.

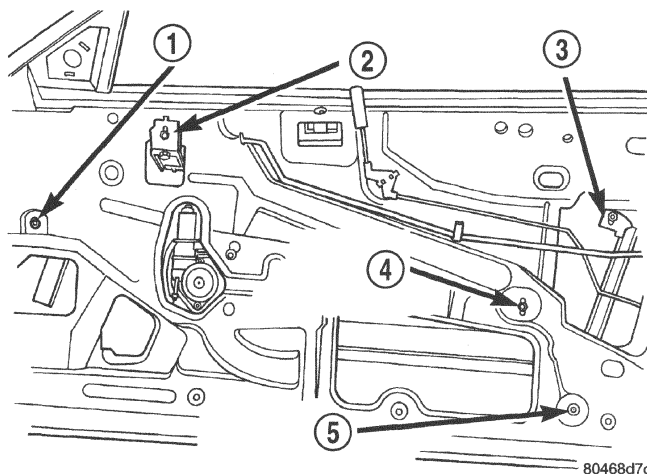
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### TOP OF GLASS – INBOARD/OUTBOARD ADJUSTMENTS

- (1) Remove door trim panel.
- (2) Remove water shield as necessary to gain access to adjusters.
- (3) Using a suitable wrench, loosen the lower jack screw jam-nuts (Fig. 85).
- (4) Remove weatherstrip from side rail weatherstrip retainer at point to be adjusted.
- (5) Close door and raise glass.
- (6) Using a suitable allen wrench, rotate jack screws to achieve the proper gap between the door glass weatherstrip retainer strip. Refer to Front Door Glass Adjustment Table.

**NOTE:** Remove only one weatherstrip section at a time or the glass to weatherstrip retainer measurements will not be accurate.

- (7) Verify that the top edge of the door glass is beneath the lip of the weatherstrip.
- (8) Tighten all fasteners.

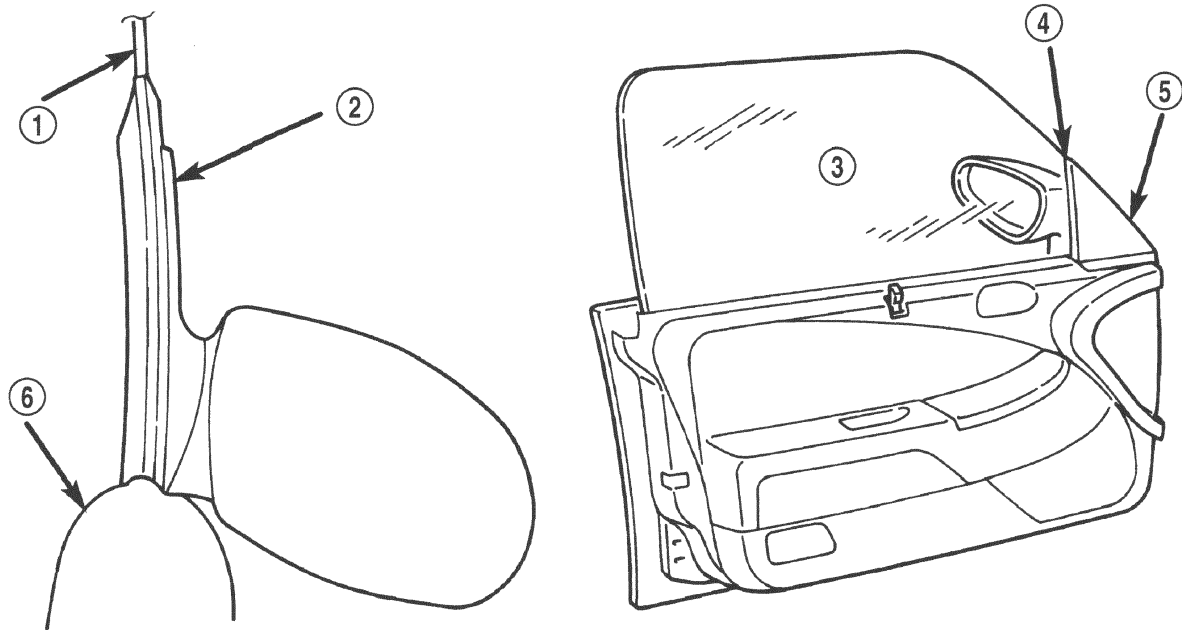


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**Fig. 85 Inboard/Outboard Glass Adjustment**

- 1 – IN/OUT JACK SCREW
- 2 – FORWARD UP-STOP
- 3 – REAR UP-STOP
- 4 – ROLLER CHANNEL ADJUSTMENT
- 5 – IN/OUT JACK SCREW



**ADJUSTMENTS (Continued)**

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**Fig. 86 Front/Rear Glass Position**

- 1 - DOOR GLASS
- 2 - MIRROR STANCHION
- 3 - DOOR GLASS

- 4 - FLUSH
- 5 - MIRROR STANCHION
- 6 - DOOR

**GLASS - FRONT/REAR ADJUSTMENT**

- (1) Remove door trim panel and water shield.
- (2) Lower door glass to gain access to glass attachments.
- (3) Loosen three glass attachment bolts.
- (4) Raise door glass and position correctly (Fig. 86).
- (5) Tighten the two accessible glass fasteners in the full up position.
- (6) Lower door glass and tighten the remaining glass fastener.
- (7) Raise glass to top of travel and verify positioning. Refer to Front Door Glass Adjustment Table and (Fig. 86).
- (8) To verify proper fit of the door glass to the header/A-pillar weatherstrip,
  - (a) Lower door glass slightly.
  - (b) Place a paper strip between the glass and weatherstrip near mirror flag and another near the front upper corner of the door glass.
  - (c) Raise glass to full up position.
  - (d) Pull the strip from between the door glass and the weatherstrip. There should be slight tension on the paper.

**DOOR GLASS ALIGNMENT VERIFICATION**

**NOTE: Door Glass Alignment Verification procedure must be done whenever the door glass is adjusted and after all adjustments are made.**

- (1) Raise quarter glass to full up position.
- (2) Close door and cycle door glass between full up and full down positions.
- (3) Verify that door glass operates smoothly and maintains correct alignment to convertible top and quarter glass.
- (4) Verify that quarter glass weatherstrip fully contacts door glass.
- (5) Verify that no scissoring of the door glass and weatherstrip occurs.
- (6) If any of the above conditions are found,
  - (a) Adjust quarter glass. Refer to Quarter Glass Adjustment procedures found in this section.
  - (b) Readjust the door glass as necessary to cure the condition.

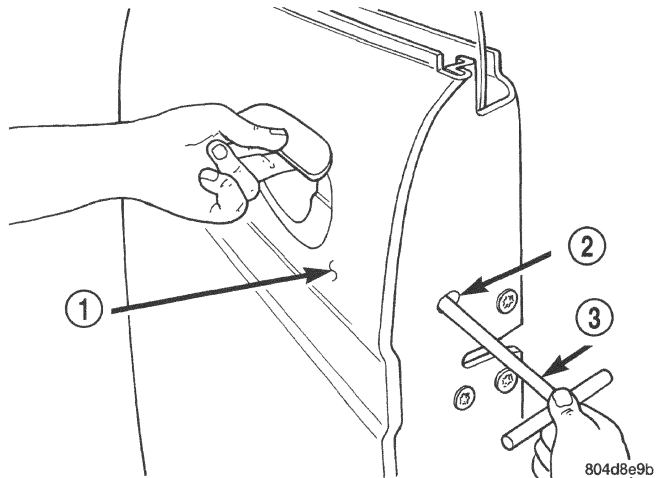
**ADJUSTMENTS (Continued)****DOOR LATCH ADJUSTMENT**

(1) Insert a suitable allen wrench through elongated slot in door end frame and loosen bolt 1/2 to one full turn (Fig. 87).

(2) Cycle outside door handle twice.

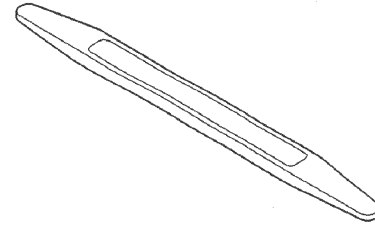
(3) Tighten adjusting screw to 3.4 N·m (30 in. lbs.) torque.

(4) Verify latch operation.



**Fig. 87 Door Latch Adjustment**

- 1 - DOOR
- 2 - SLOT
- 3 - ALLEN WRENCH

**SPECIAL TOOLS****BODY**

**STICK, TRIM C 4755**

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# SPECIFICATIONS

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## SPECIFICATIONS

### BODY LUBRICATION SPECIFICATIONS

#### LUBRICATION REQUIREMENTS

Body mechanisms and linkages should be inspected, cleaned, and lubricated, as required, to maintain ease of operation and to provide protection against rust and wear. When performing other under hood services, the hood latch release mechanism and safety catch should be inspected, cleaned, and lubricated. During the winter season, external door lock cylinders should be lubricated to assure proper operation when exposed to water and ice.

Prior to the application of any lubricant, the parts concerned should be wiped clean to remove dust and grit. If necessary, a suitable solvent can be used to clean the item to be lubricated. After lubricating a component, any excess oil or grease should be removed.

#### LUBRICANT APPLICATION

##### DOOR LOCK CYLINDERS

(1) Apply a small amount of lubricant directly into the lock cylinder.

(2) Apply a small amount of lubricant to the key.

(3) Insert key into lock cylinder and cycle the mechanism from the locked to the unlocked position.

**NOTE:** Do not add more lubricant.

(4) Cycle the lock cylinder mechanism several times to allow the lubricant to flow throughout the cylinder.

(5) Wipe all lubricant from exterior of lock cylinder and key.

#### ALL OTHER BODY MECHANISMS

(1) Clean component as described above.

(2) Apply specified lubricant to all pivoting and sliding contact areas of component.

#### LUBRICANT USAGE

##### ENGINE OIL

- Hood Hinges – Pivot Points
- Decklid Hinges

##### **MOPAR® SPRAY WHITE LUBE OR EQUIVALENT**

- Door Check Straps
- Decklid Prop Pivots
- Ash Receiver
- Parking Brake Mechanism
- Sliding Seat Tracks
- Decklid Latch

##### **MOPAR® Multipurpose GREASE OR EQUIVALENT**

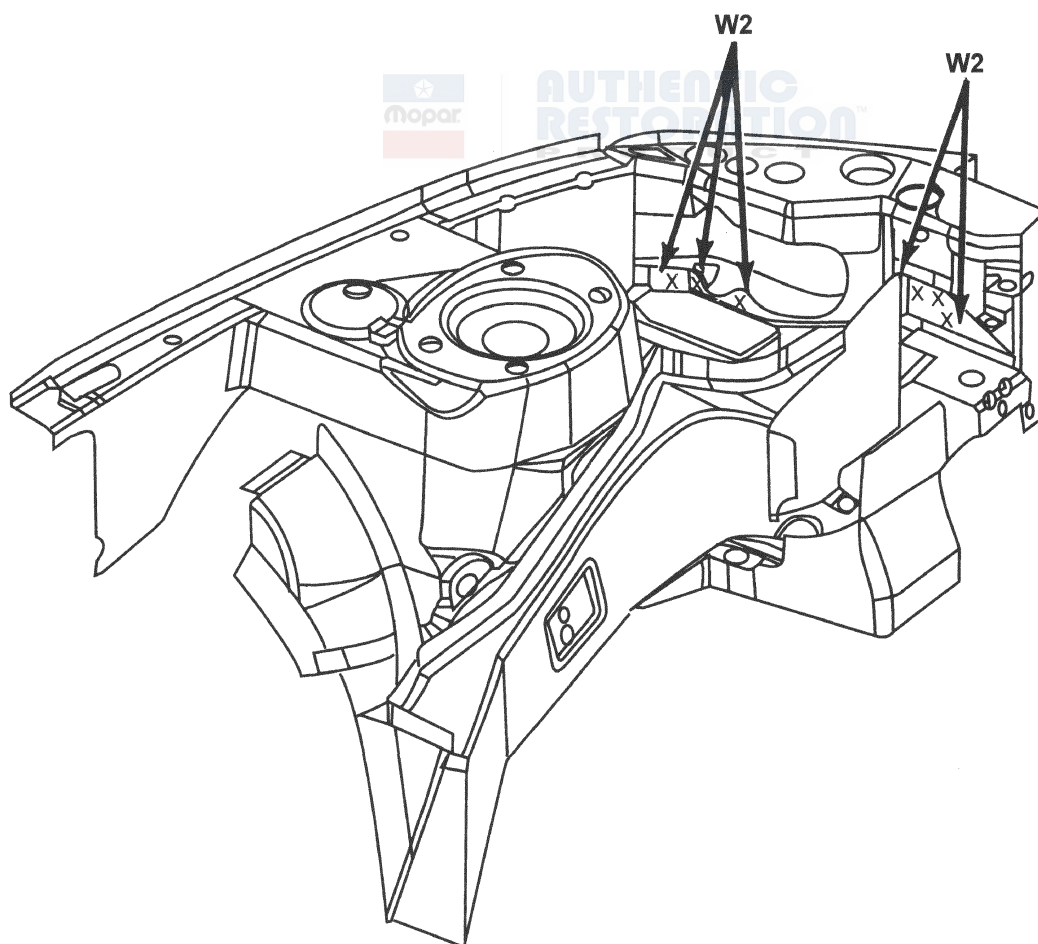
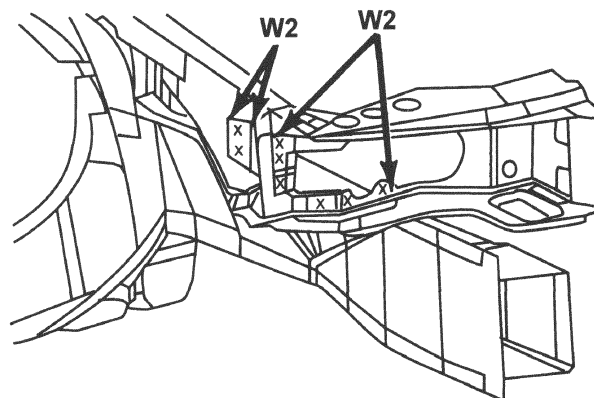
- All Other Hood Mechanisms
- Door Hinges – Hinge Pin and Pivot Contact Areas

##### **MOPAR® LOCK CYLINDER LUBRICANT OR EQUIVALENT**

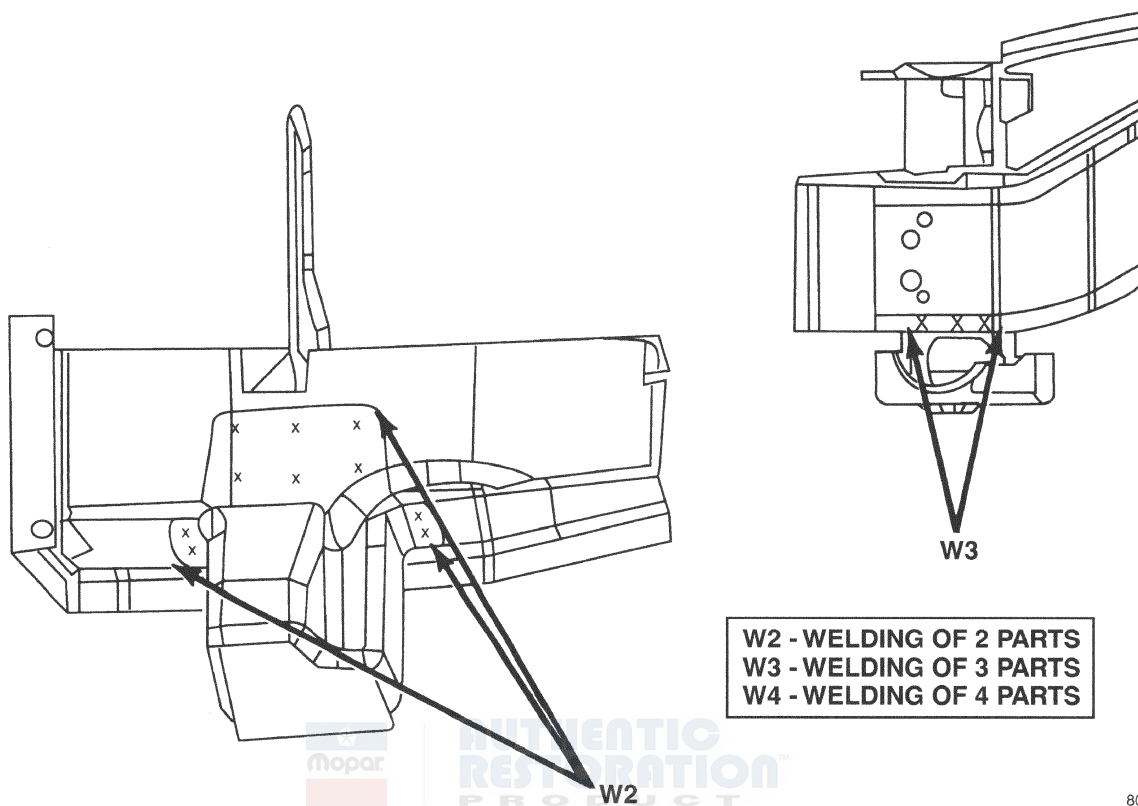
- Door Lock Cylinders
- Decklid Lock Cylinder

**SPECIFICATIONS (Continued)****WELD LOCATIONS****HEADLAMP AND RADIATOR SUPPORTS**

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W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS



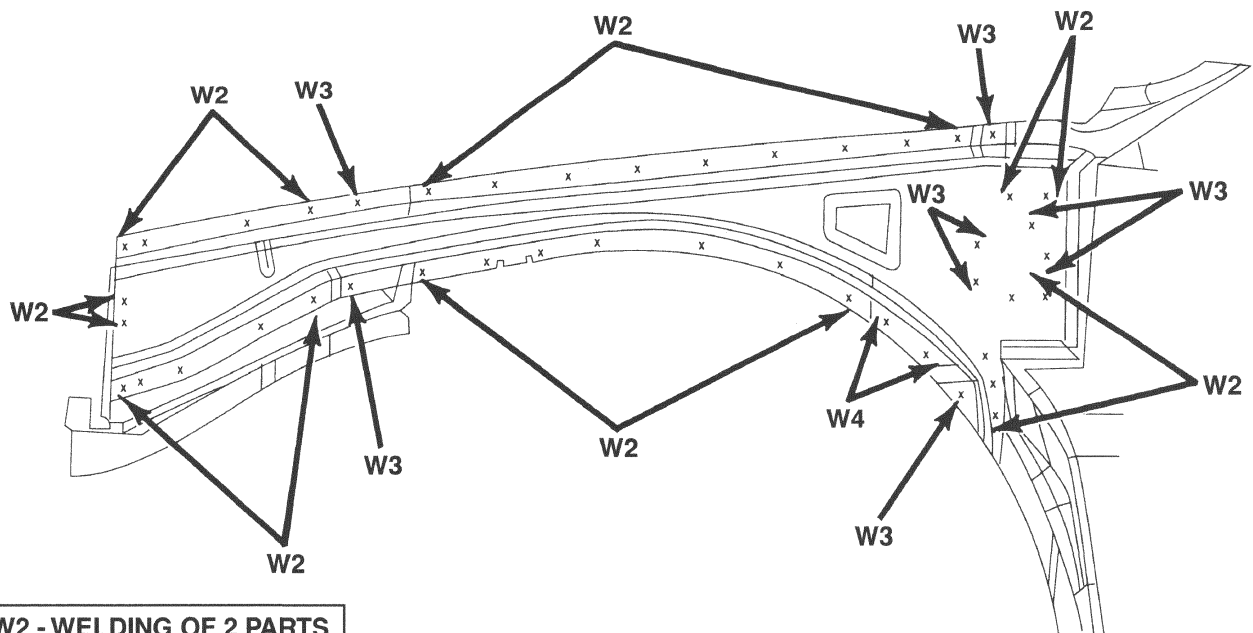


**SPECIFICATIONS (Continued)****HEADLAMP AND RADIATOR SUPPORTS**

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## SPECIFICATIONS (Continued)

## UPPER LOAD PATH BEAM - OUTER



W2 - WELDING OF 2 PARTS  
W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS

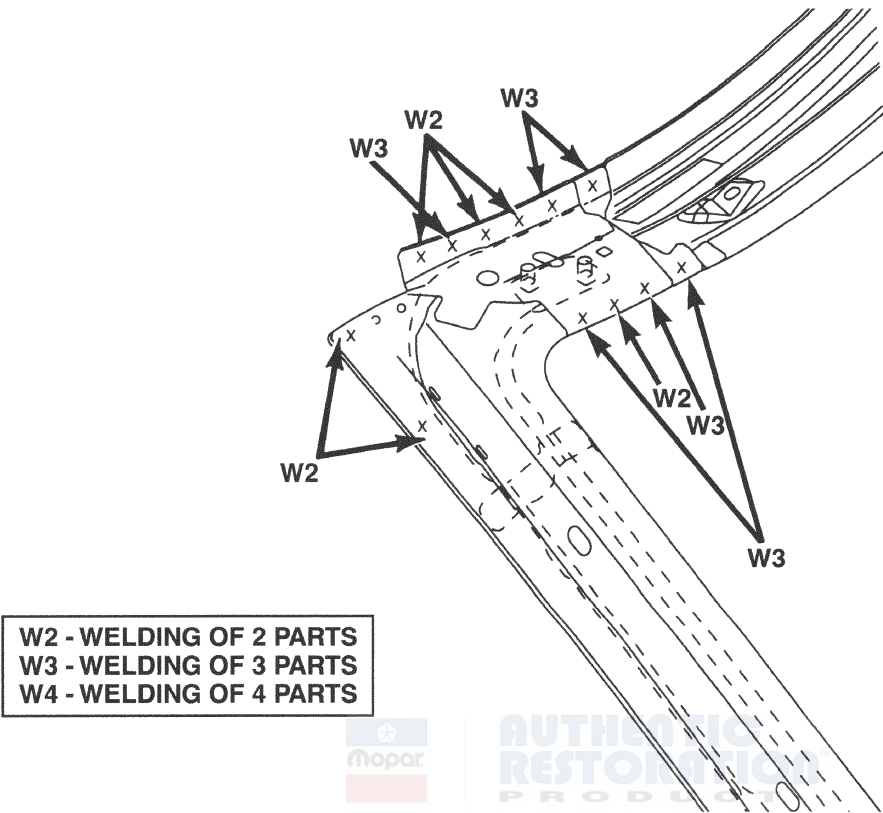


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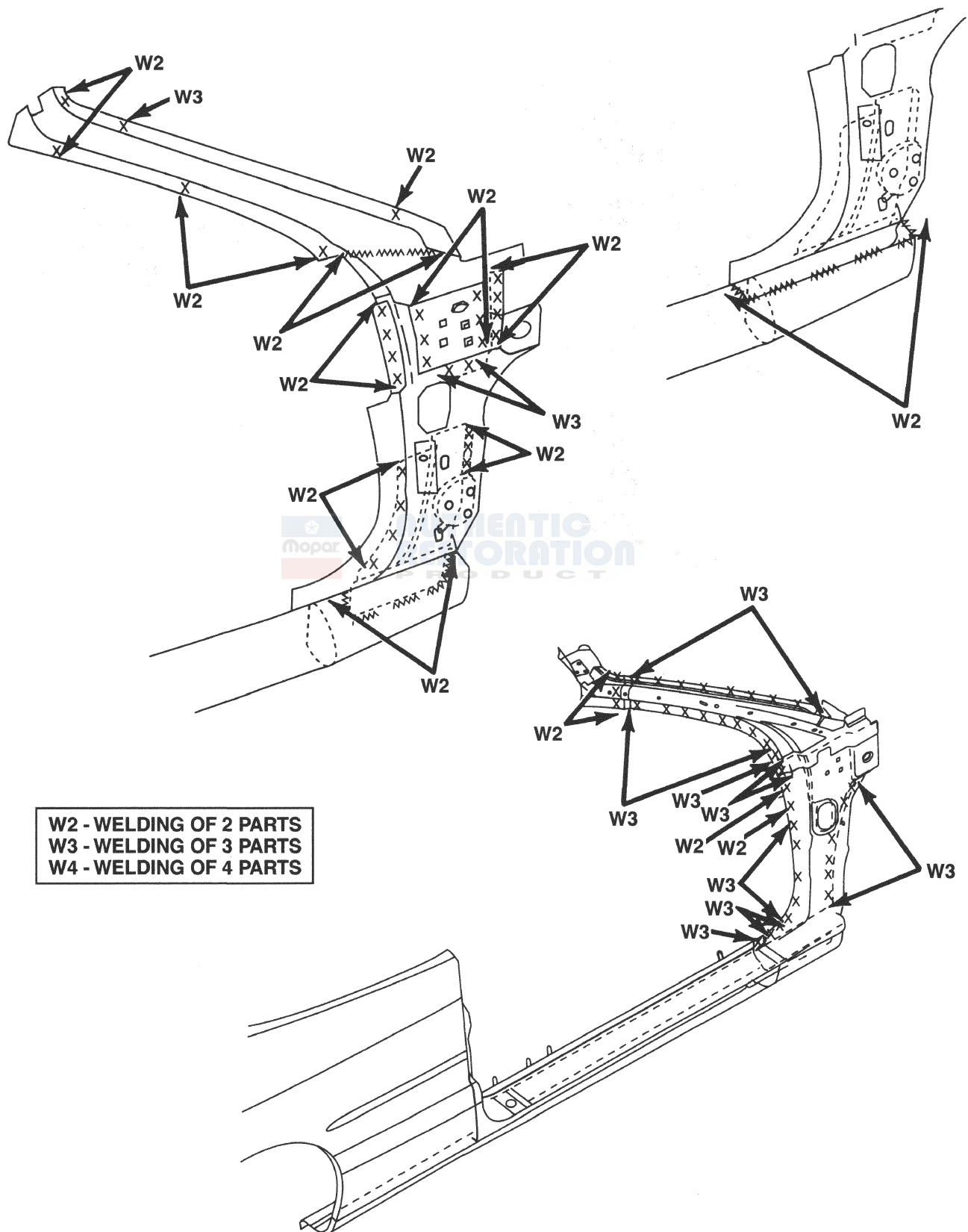
SPECIFICATIONS (Continued)

HINGE PILLAR AND UPPER A-PILLAR



## SPECIFICATIONS (Continued)

## HINGE PILLAR AND UPPER A-PILLAR

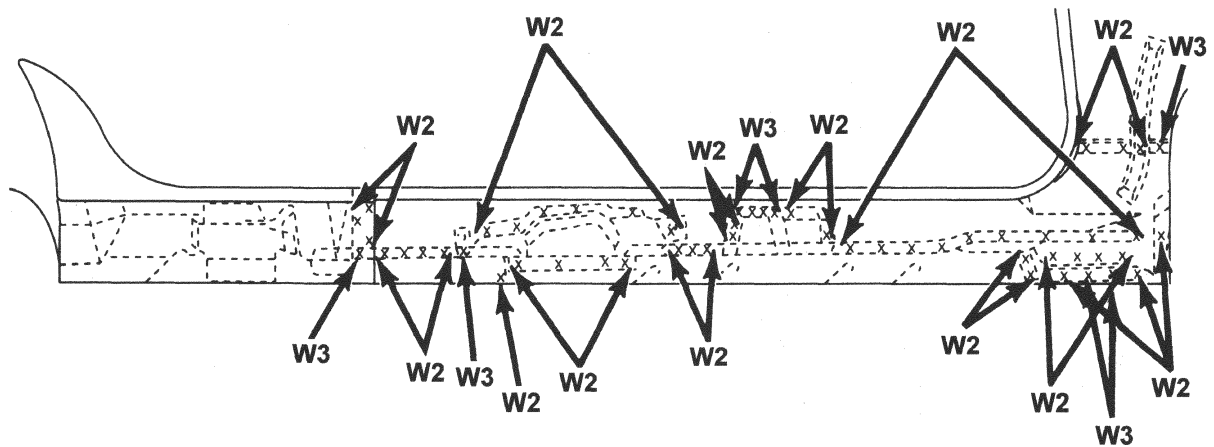




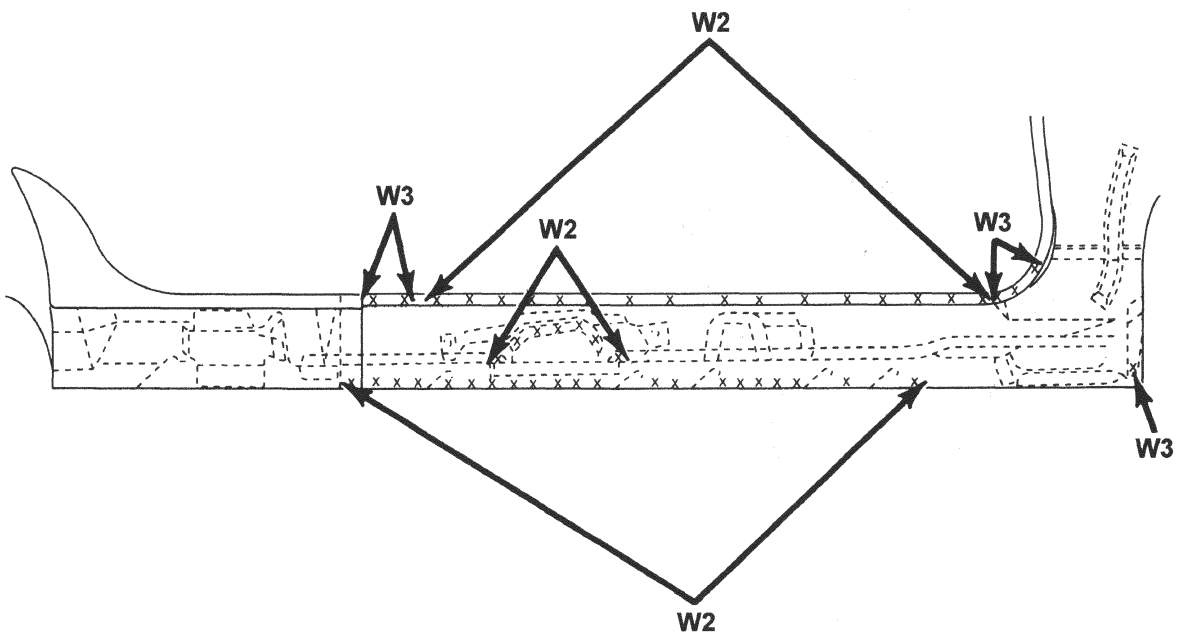
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**SPECIFICATIONS (Continued)**

**SIDE SILL - INNER AND OUTER**

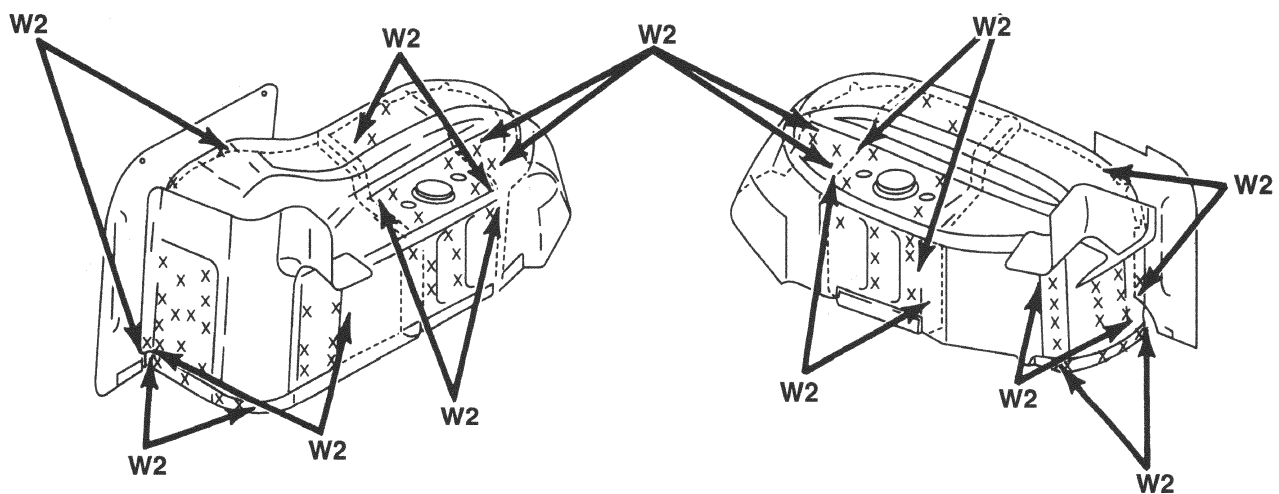


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 W3 - WELDING OF 3 PARTS  
 W4 - WELDING OF 4 PARTS

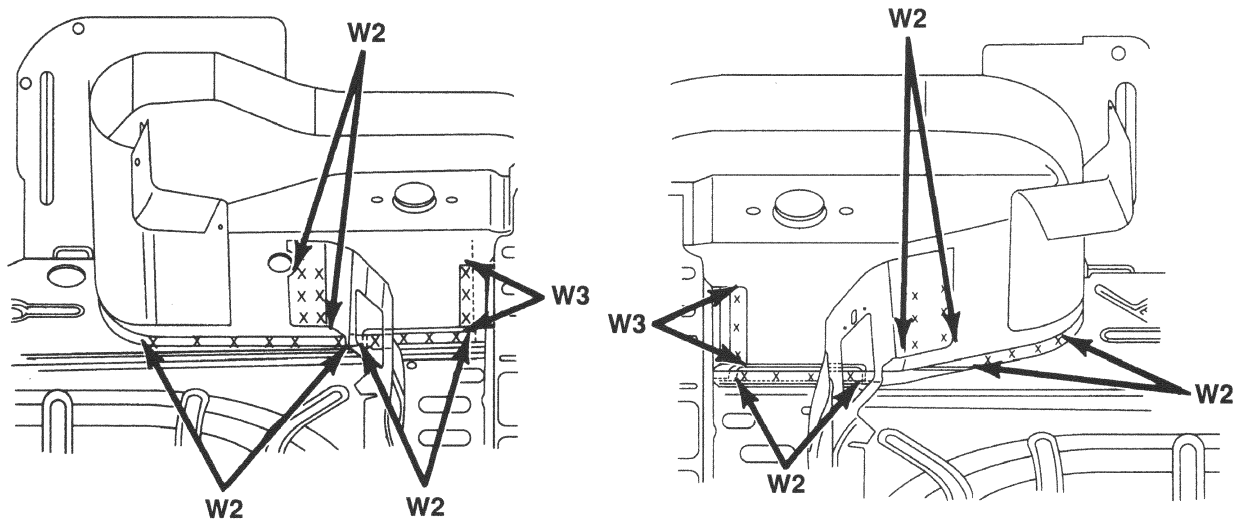


## SPECIFICATIONS (Continued)

## INNER WHEELHOUSE - REAR



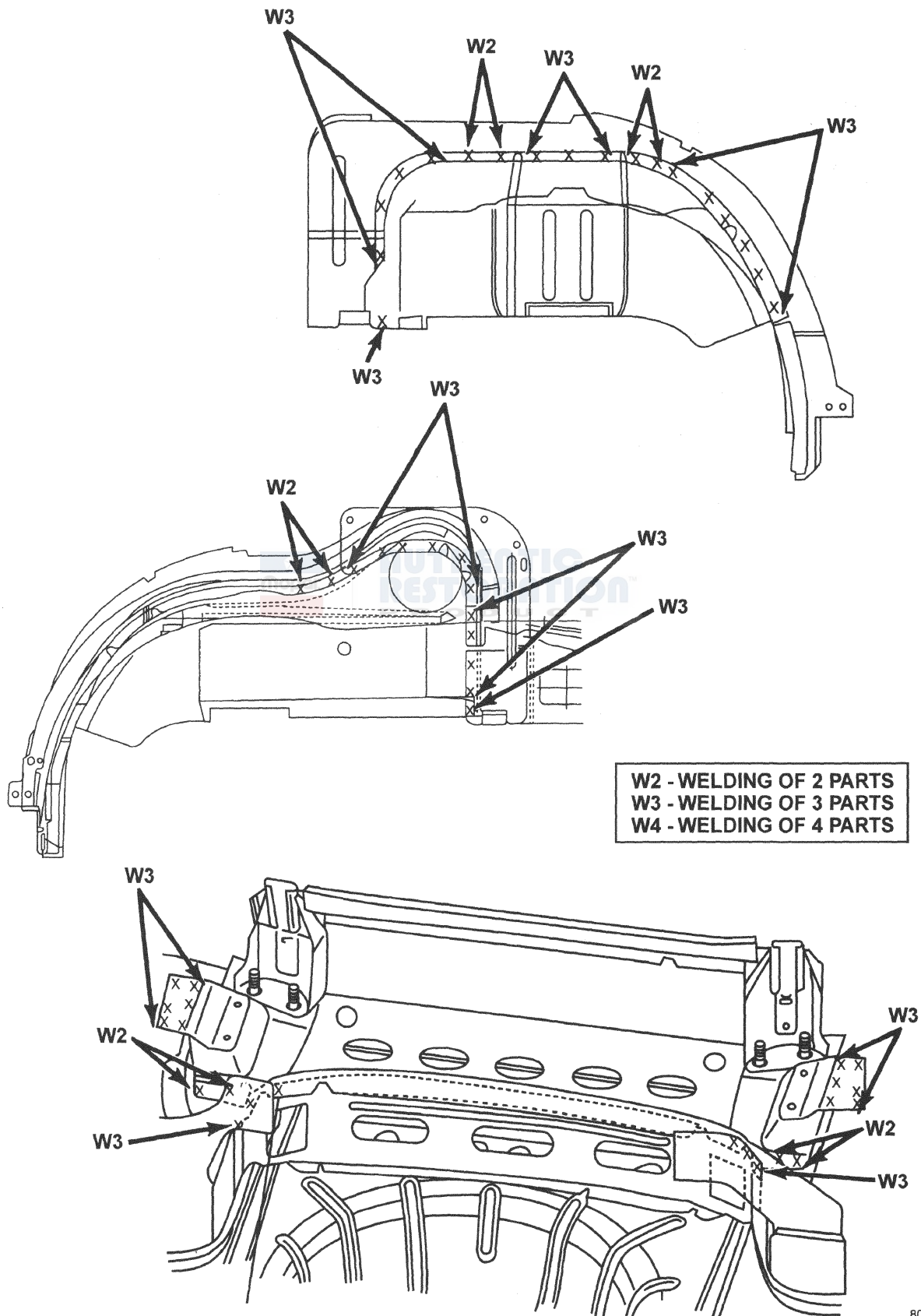
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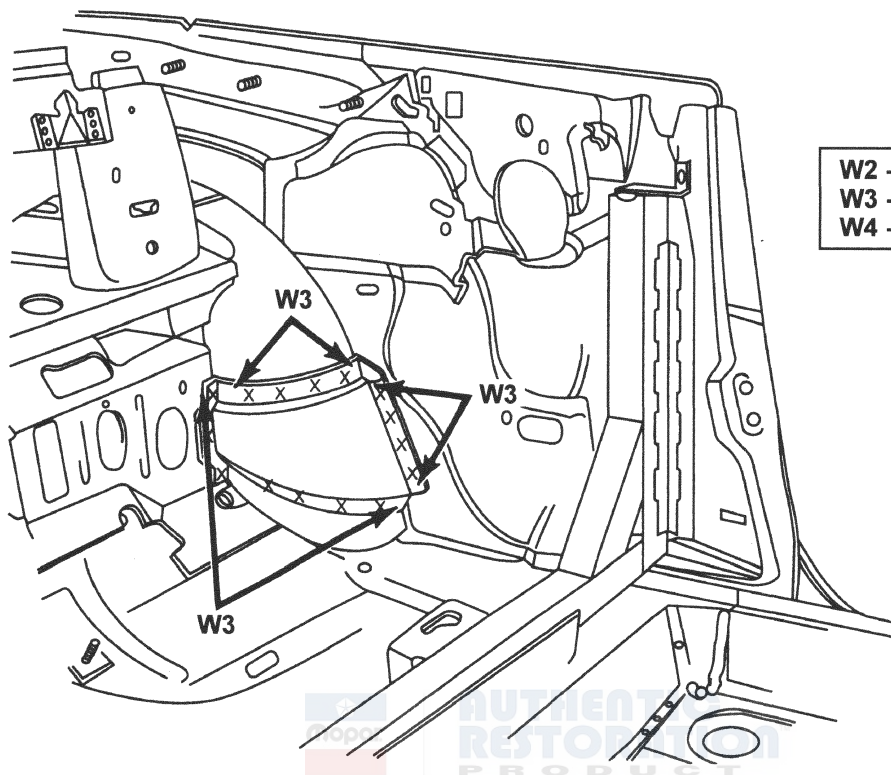
**W2 - WELDING OF 2 PARTS  
W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS**

## SPECIFICATIONS (Continued)

## INNER WHEELHOUSE - REAR





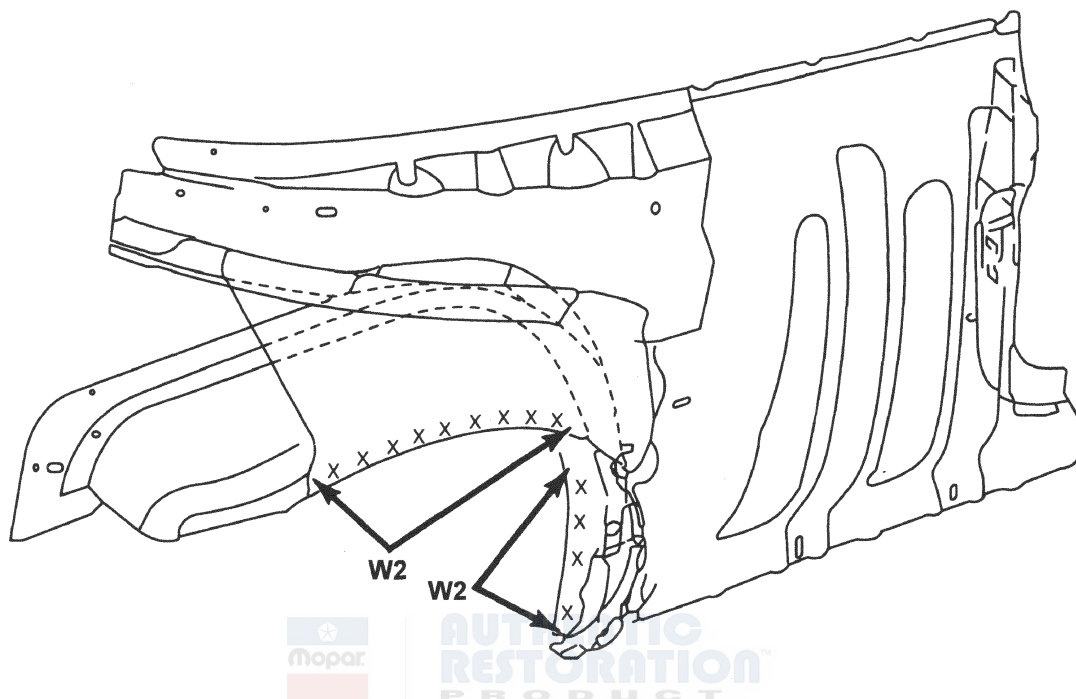
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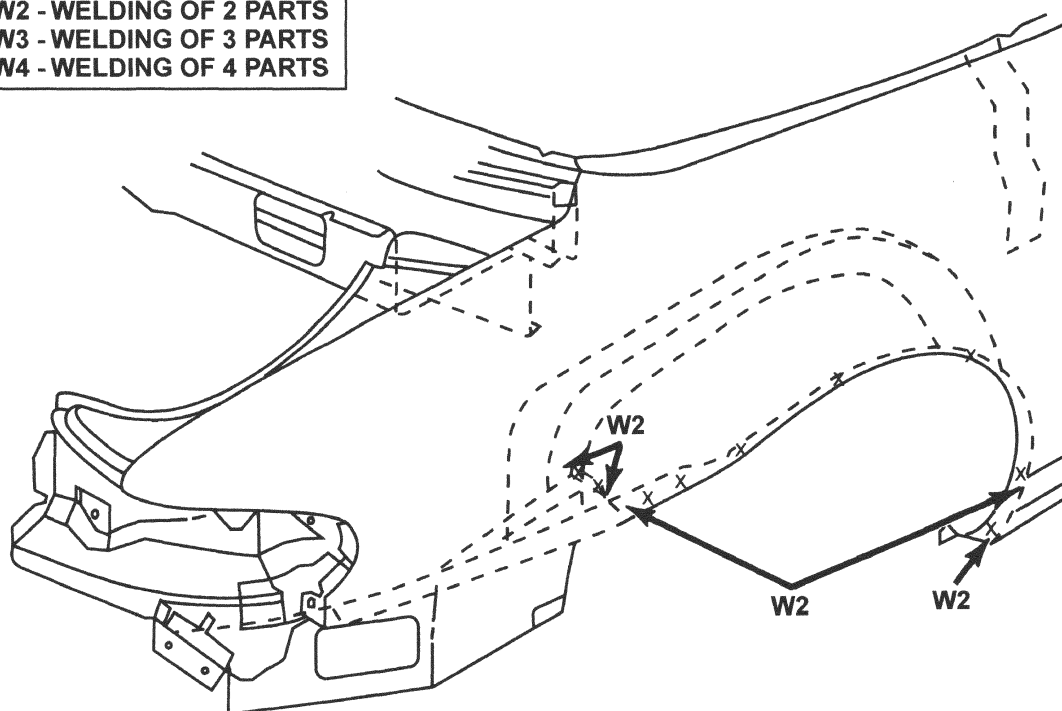
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## SPECIFICATIONS (Continued)

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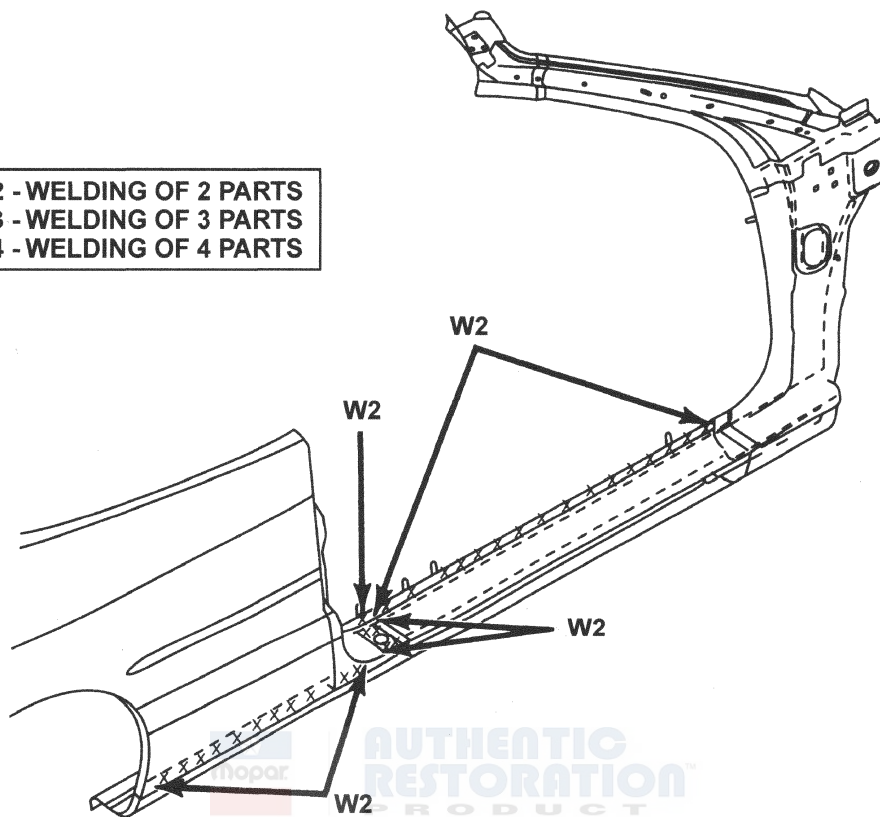


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W4 - WELDING OF 4 PARTS



**SPECIFICATIONS (Continued)****QUARTER PANEL**

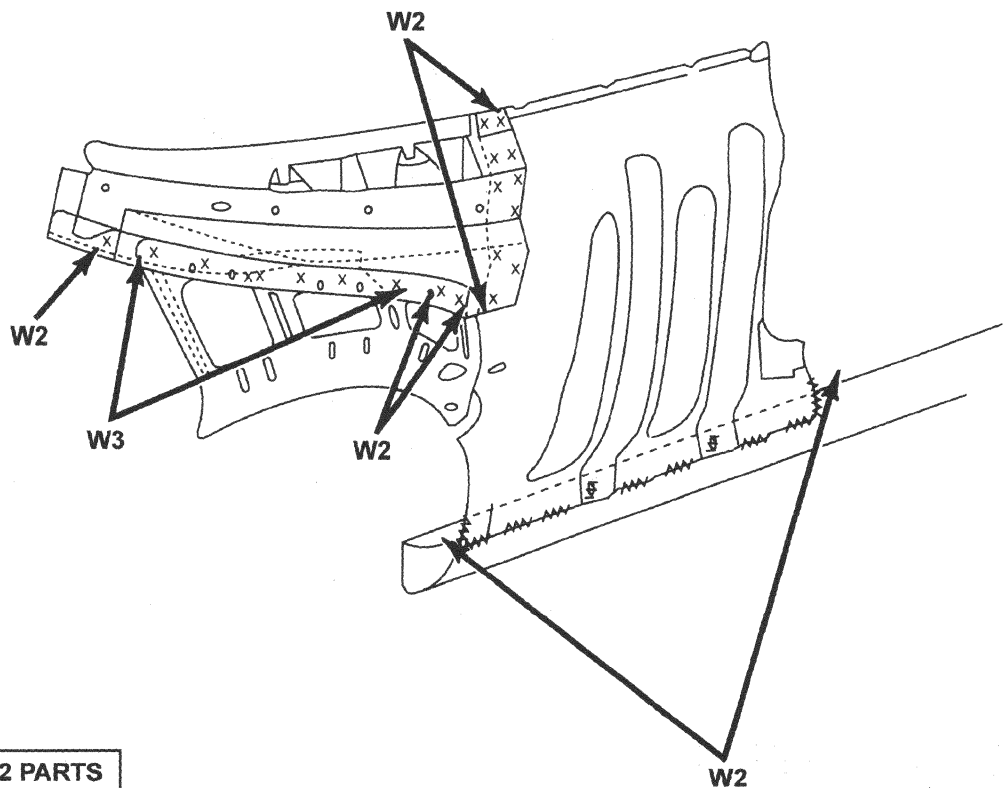
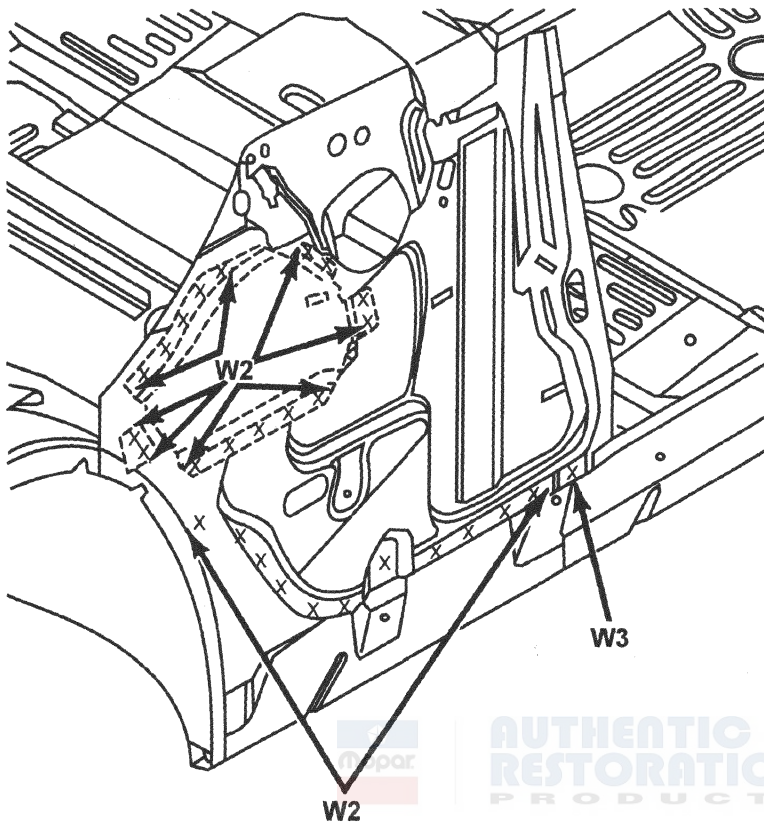
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W4 - WELDING OF 4 PARTS



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## SPECIFICATIONS (Continued)

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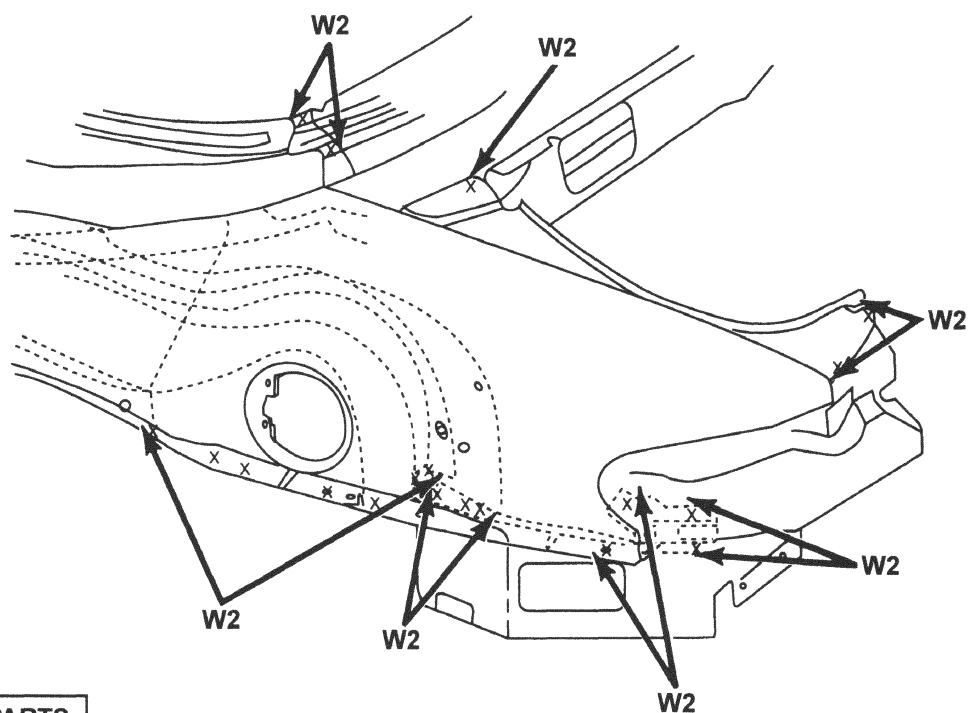
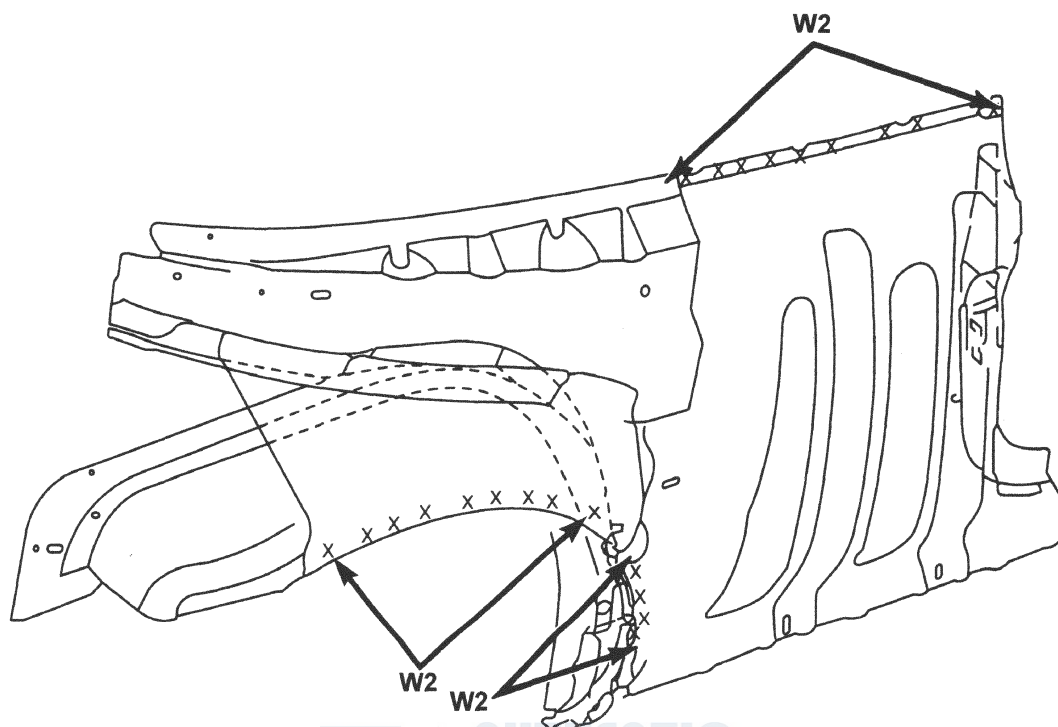


W2 - WELDING OF 2 PARTS  
W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS



## SPECIFICATIONS (Continued)

## QUARTER PANEL



W2 - WELDING OF 2 PARTS  
W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS

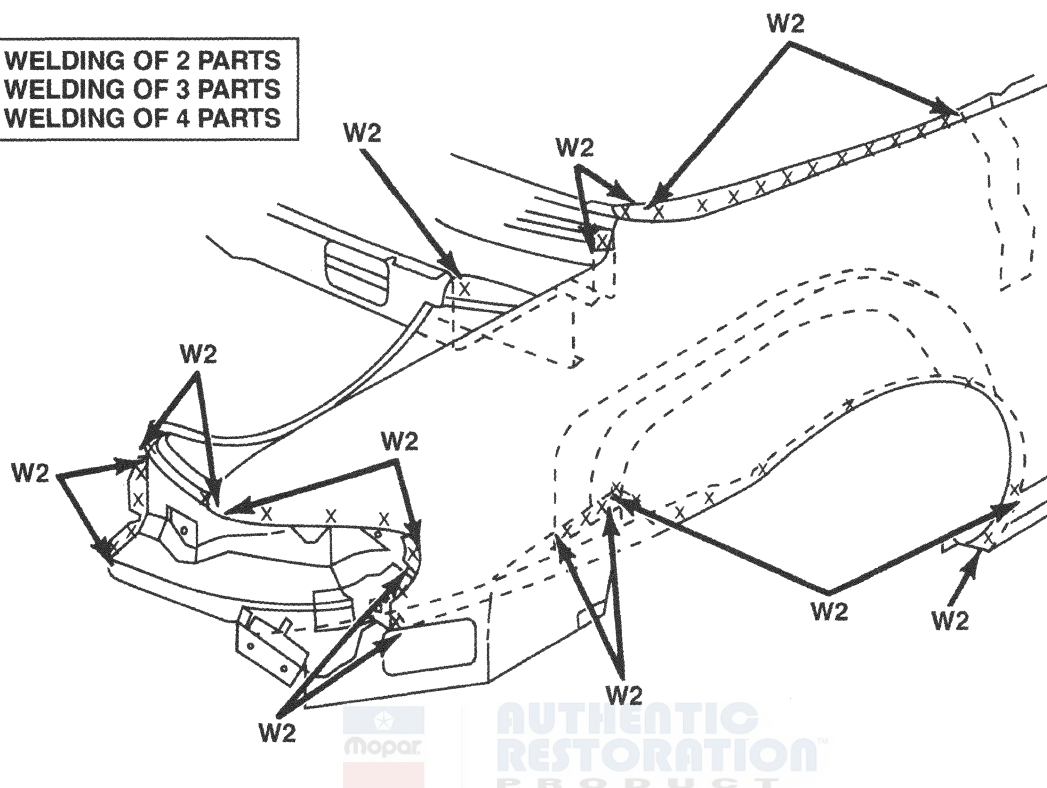
## QUARTER PANEL



## SPECIFICATIONS (Continued)

## QUARTER PANEL

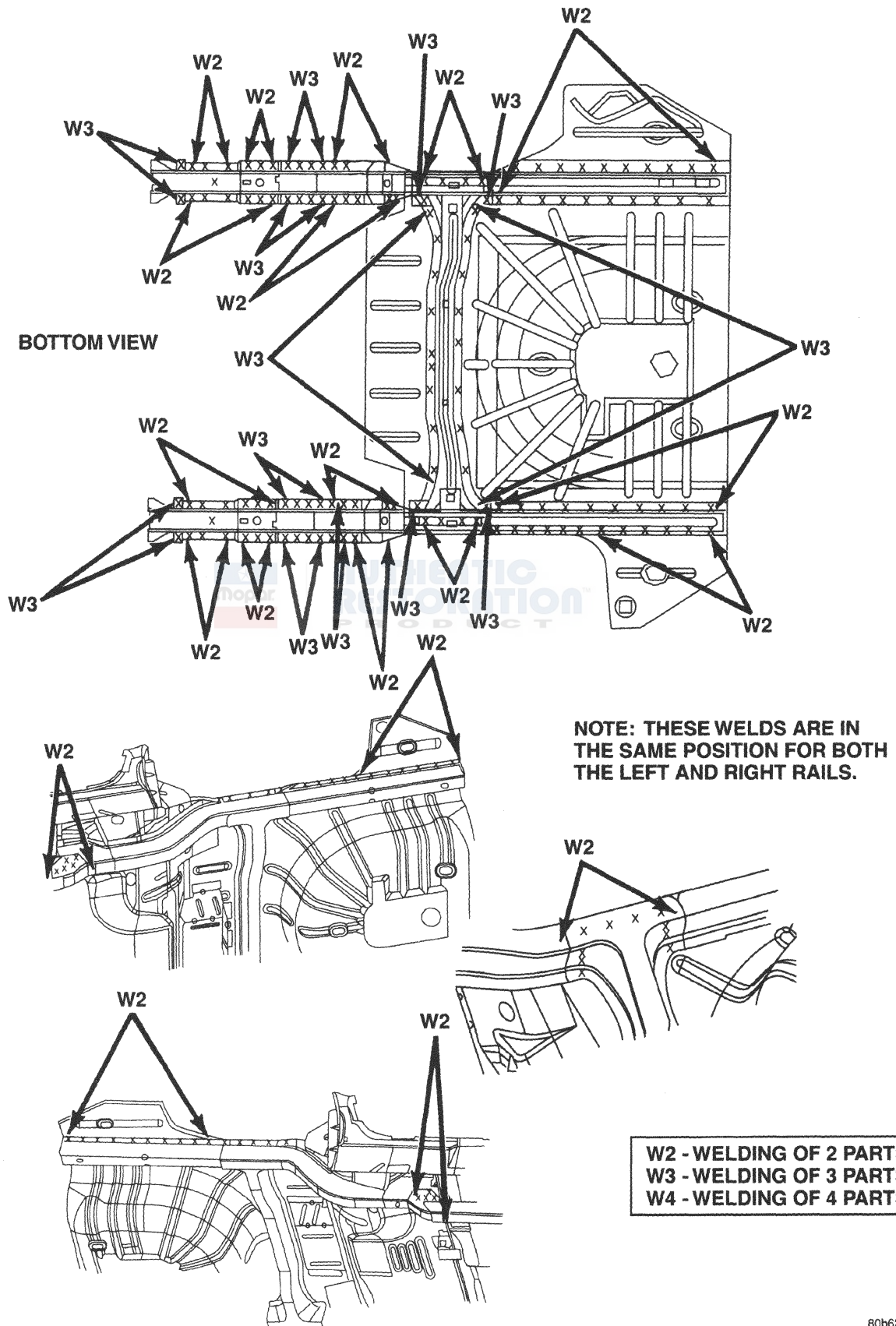
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W4 - WELDING OF 4 PARTS



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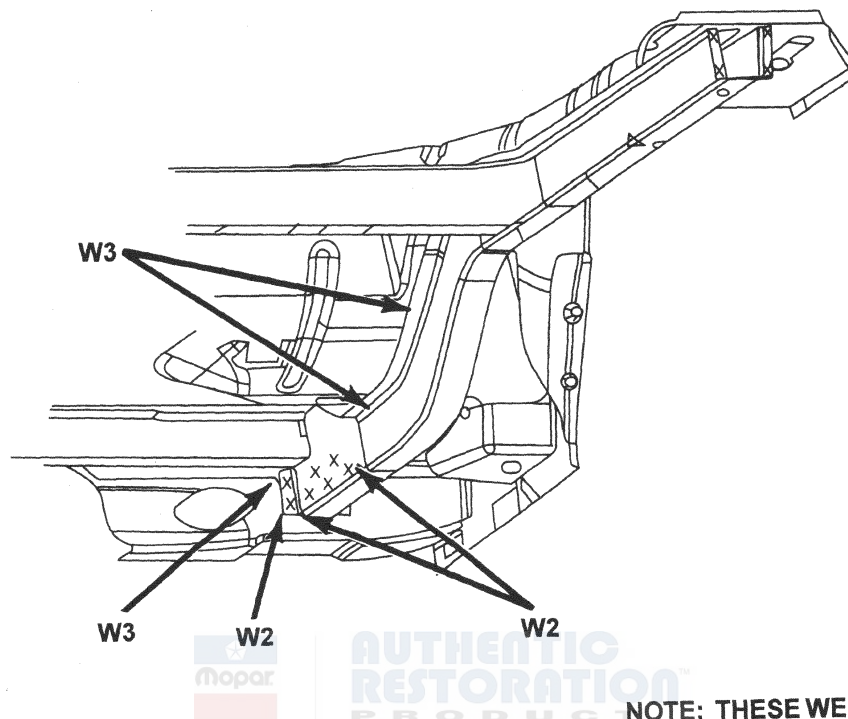
## REAR FRAME RAIL



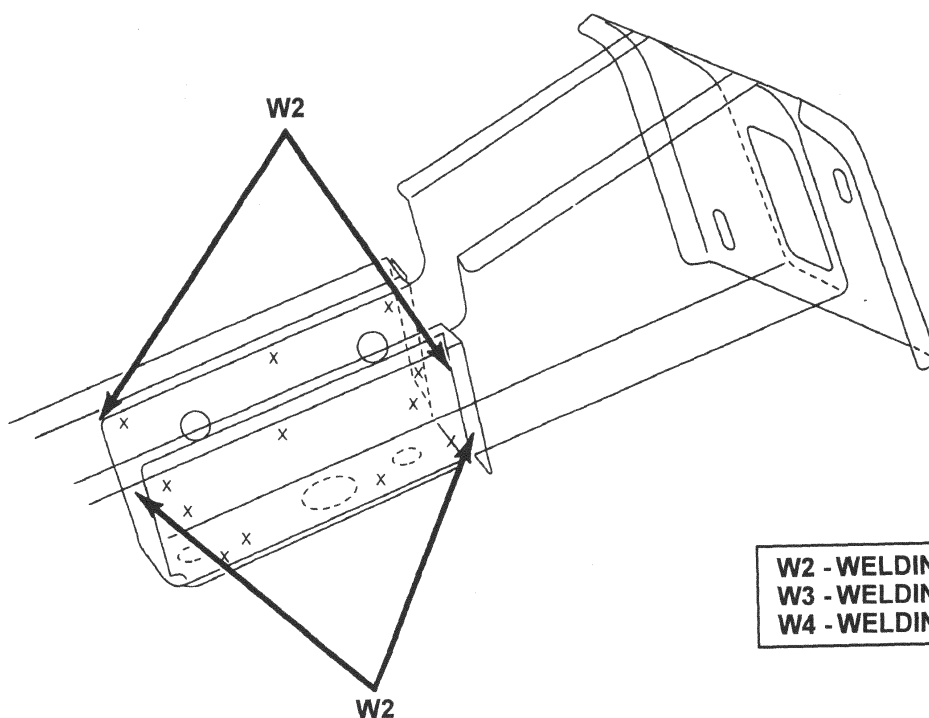


**SPECIFICATIONS (Continued)**

**REAR FRAME RAIL**



NOTE: THESE WELDS ARE IN THE SAME POSITION FOR BOTH THE LEFT AND RIGHT RAILS.

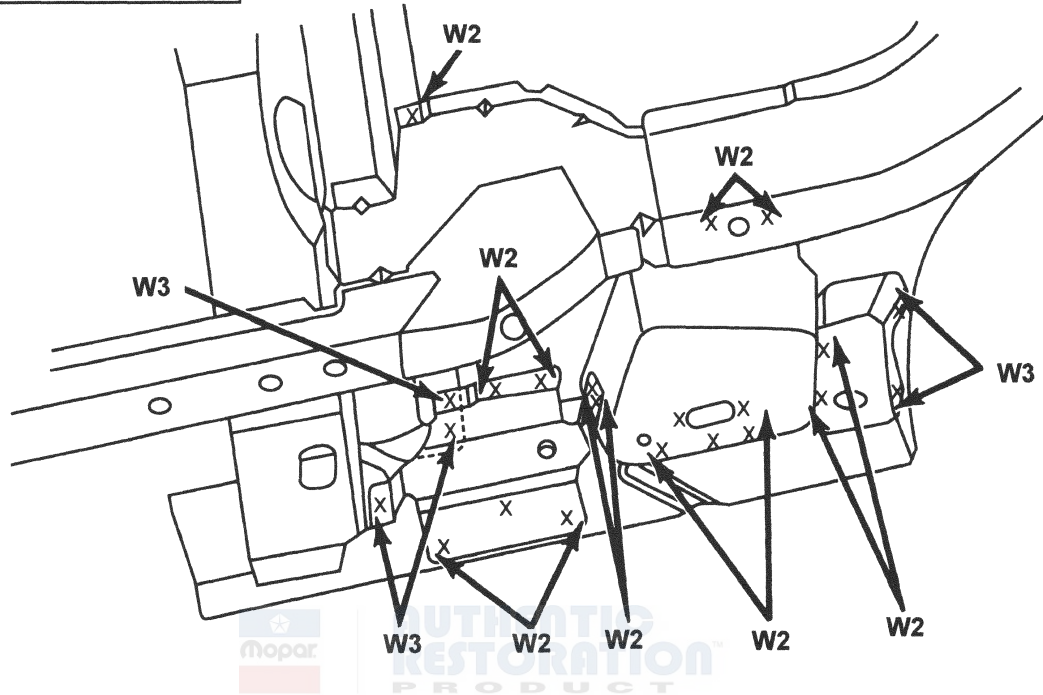


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W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS

## SPECIFICATIONS (Continued)

## REAR FRAME RAIL

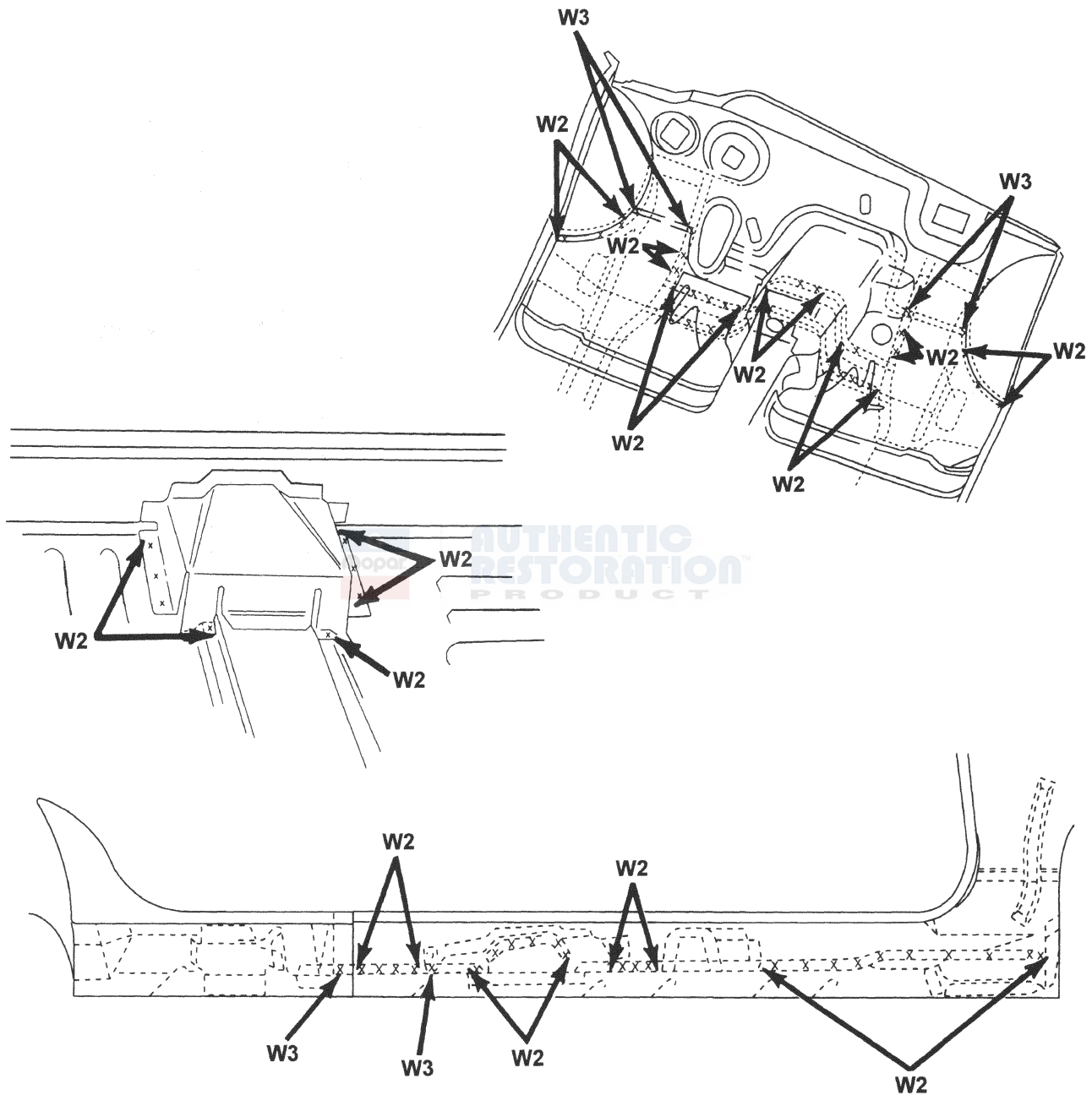
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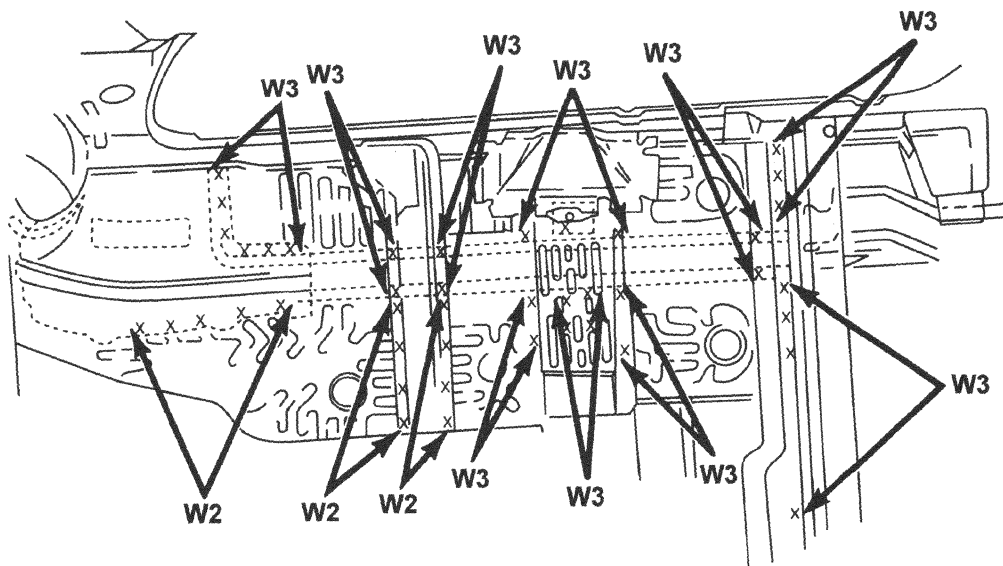
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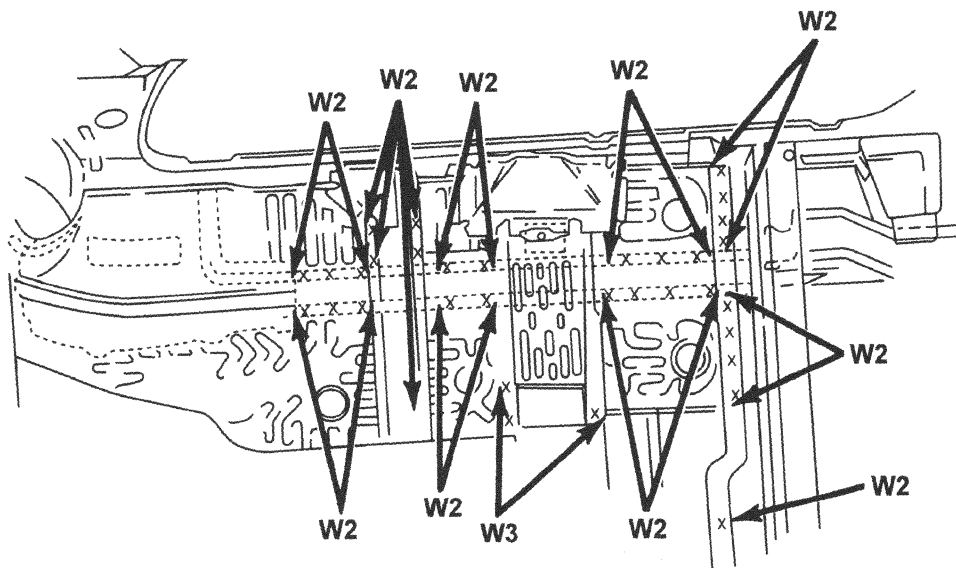
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W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS

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## FRONT FLOOR PAN



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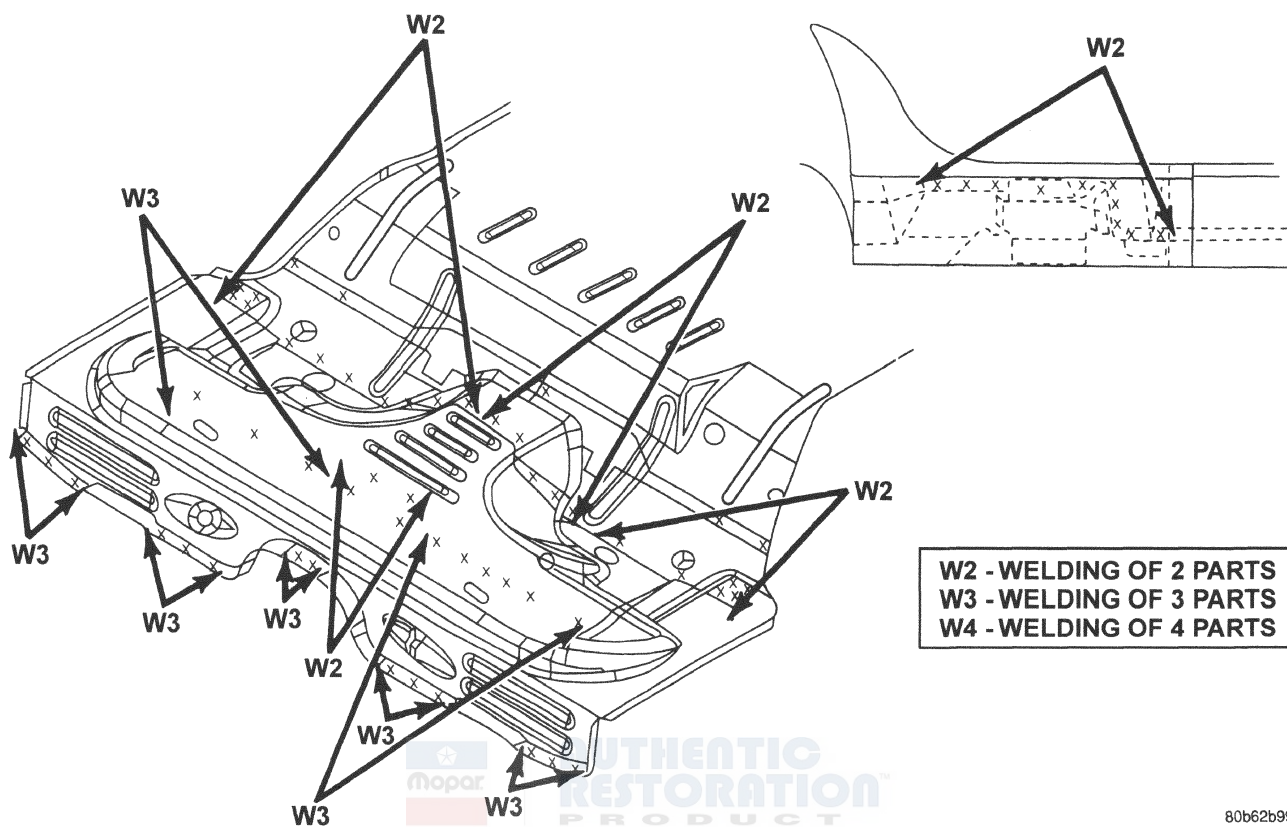


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W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS



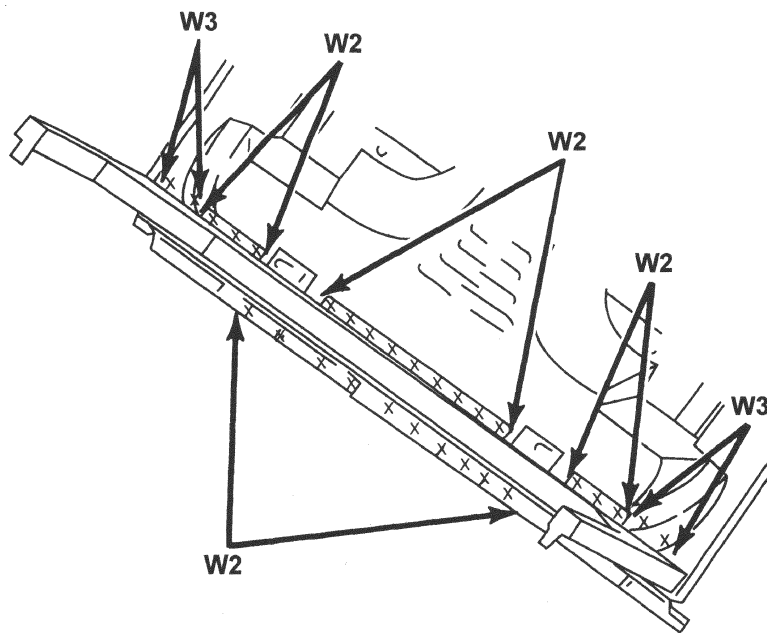
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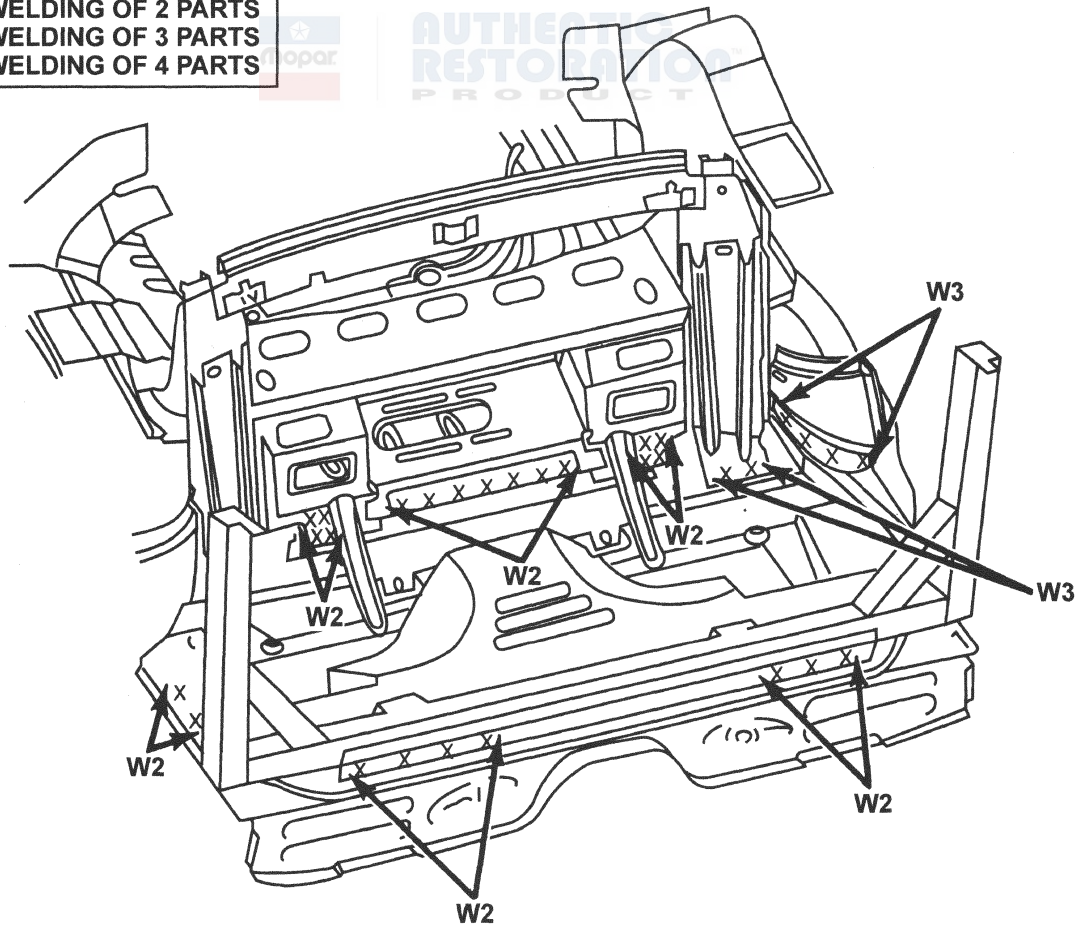


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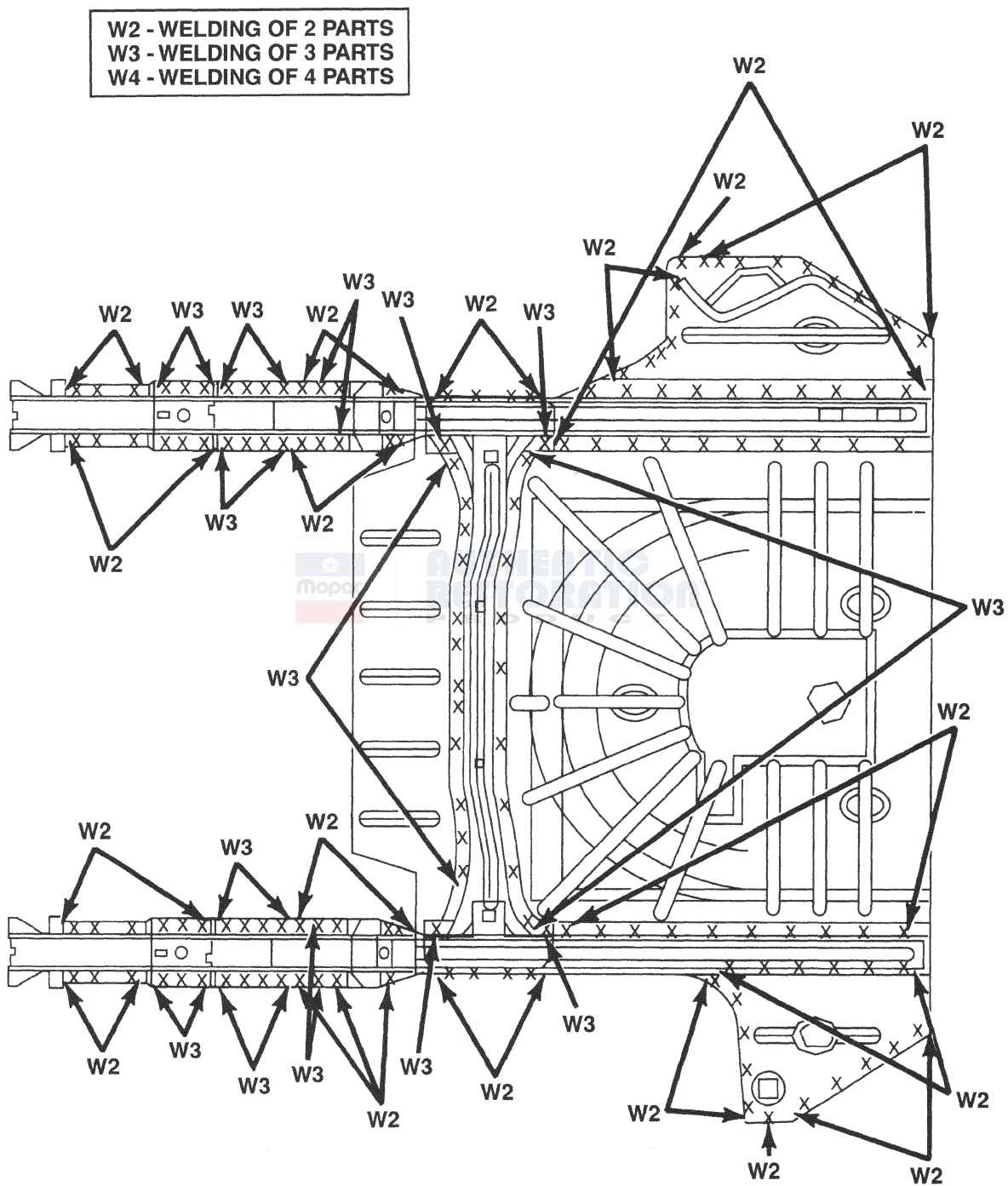


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W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS



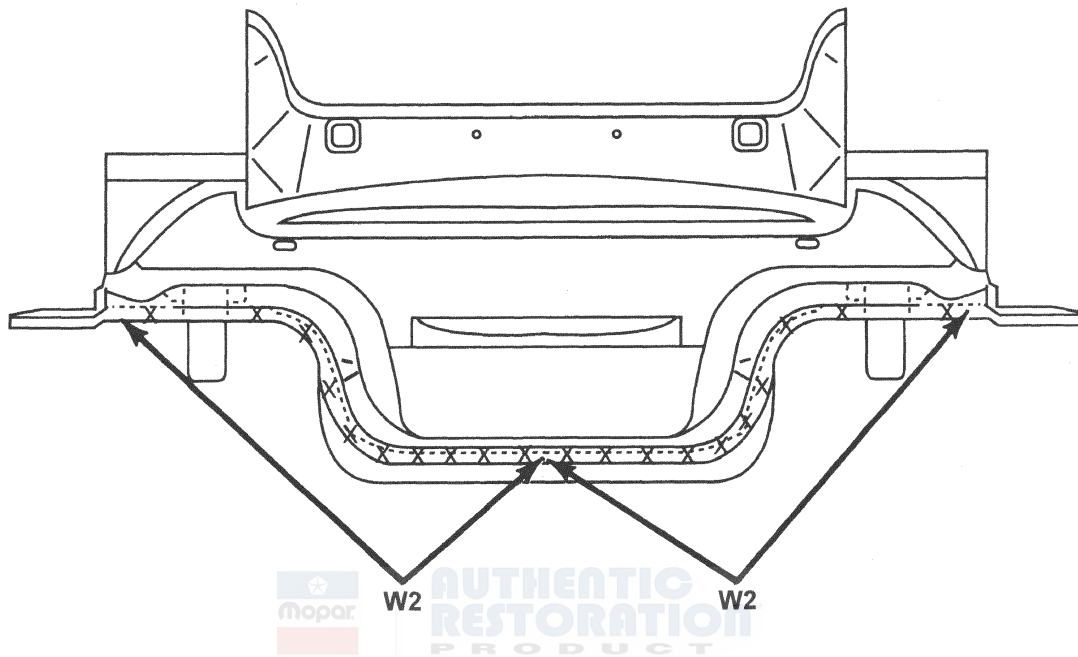
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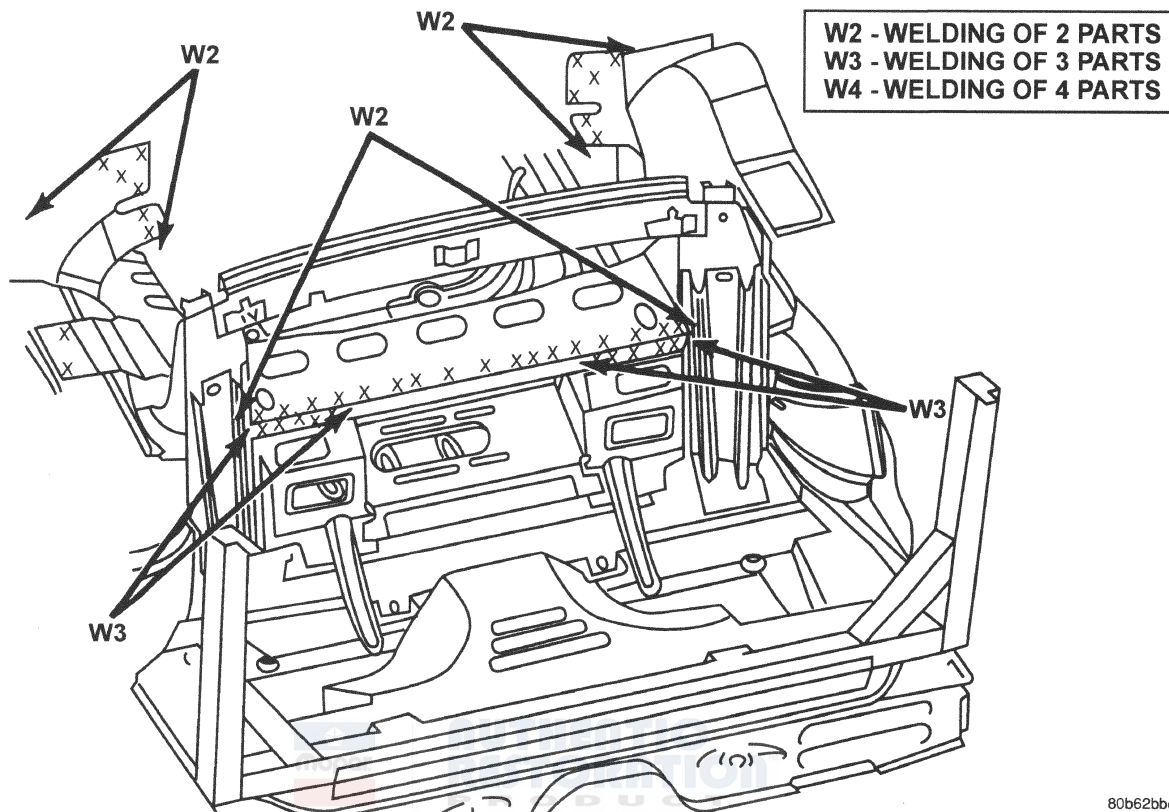
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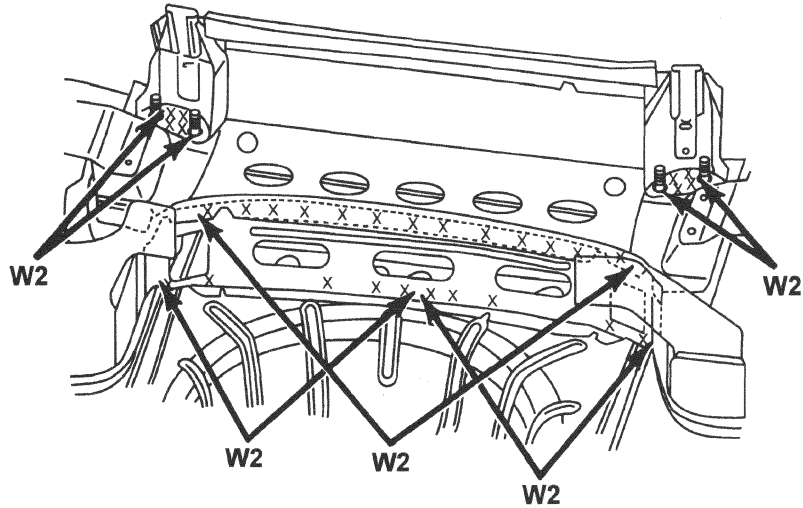


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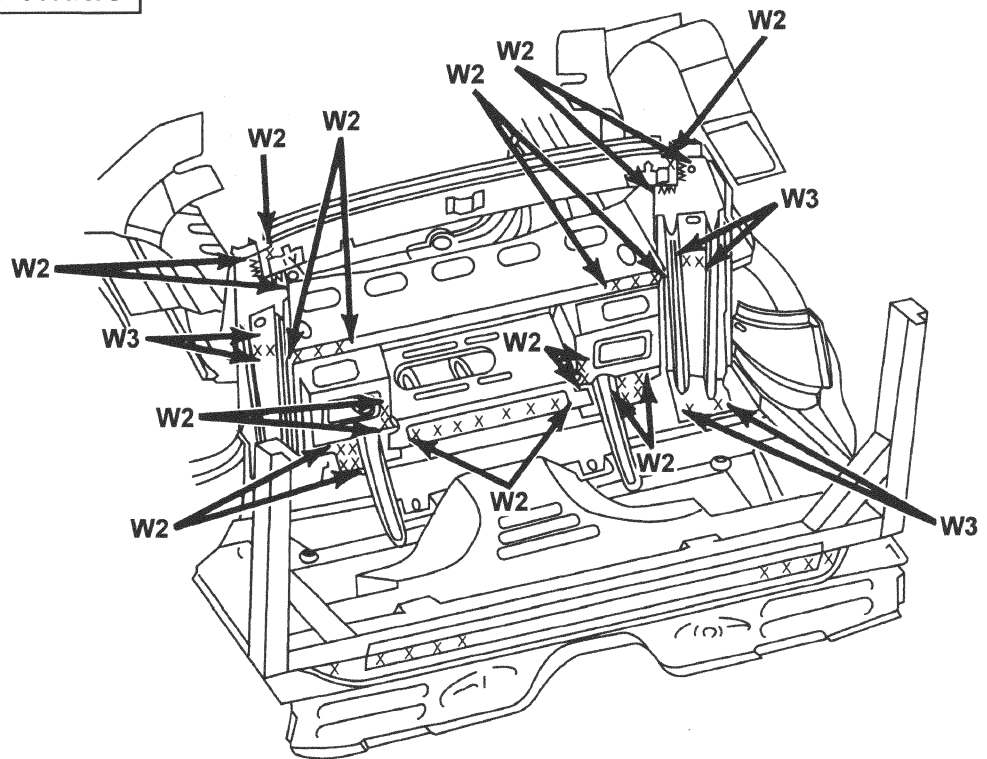
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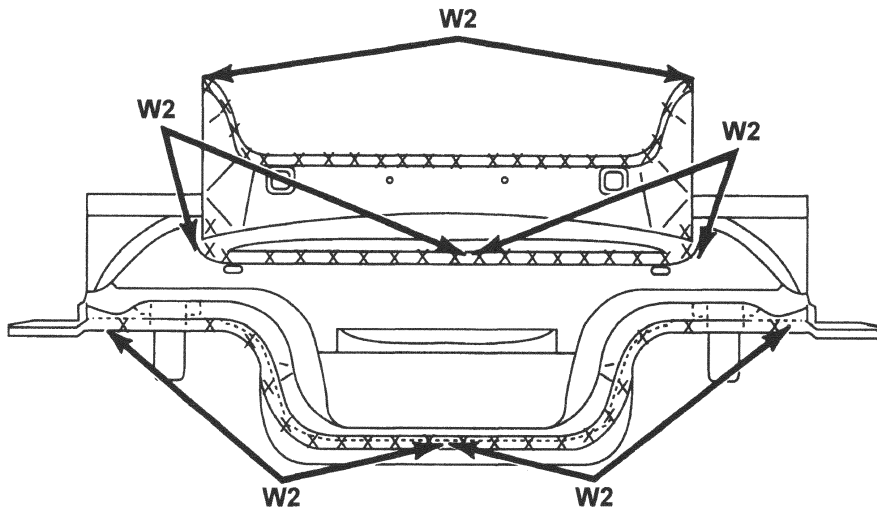
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## REAR DECK OPENING AND TOP WELL

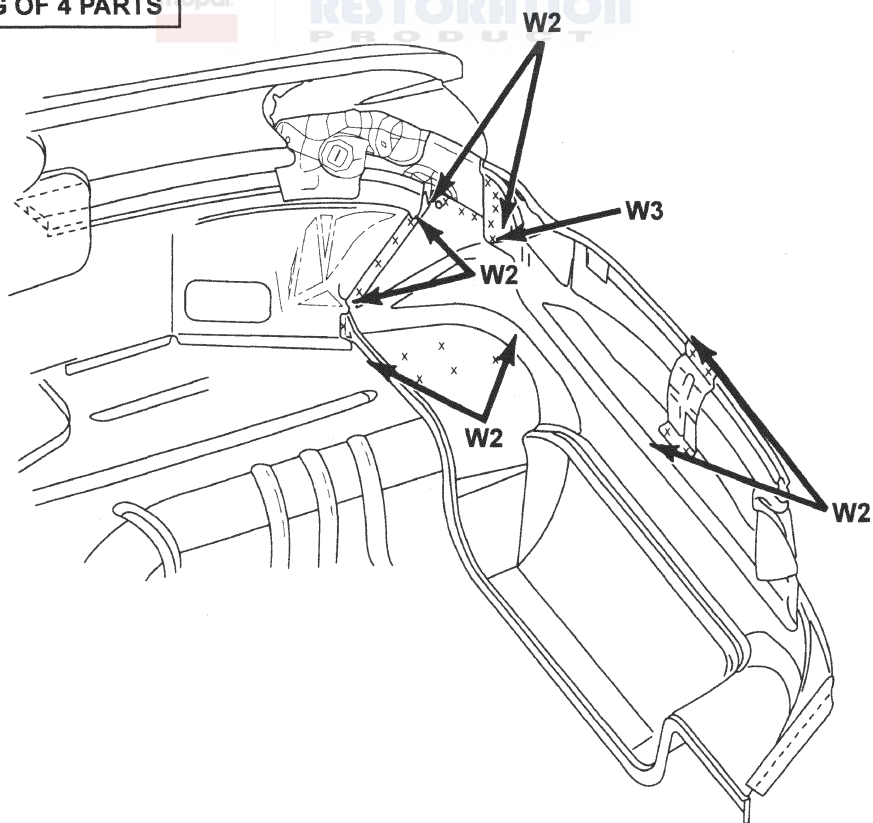


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**SPECIFICATIONS (Continued)****REAR DECK OPENING AND TOP WELL**

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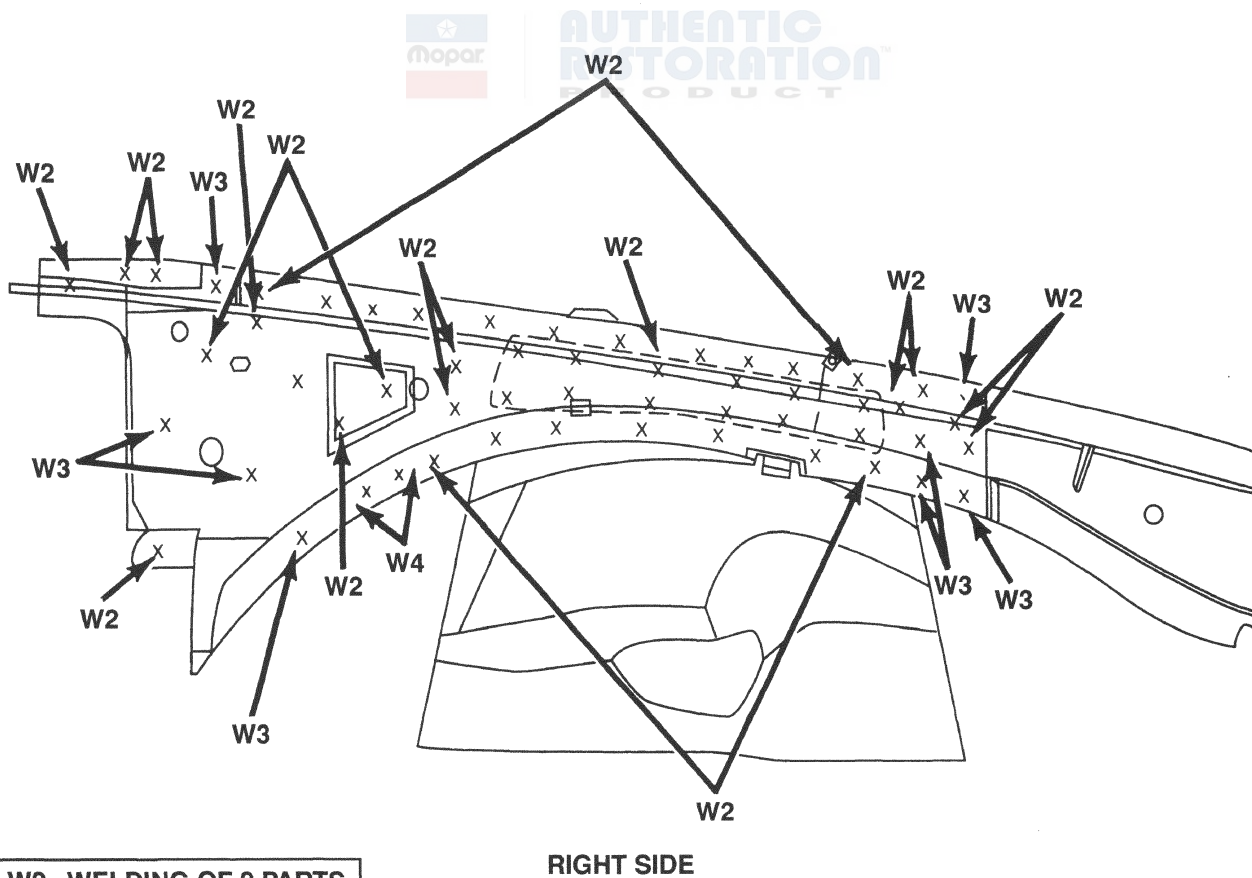
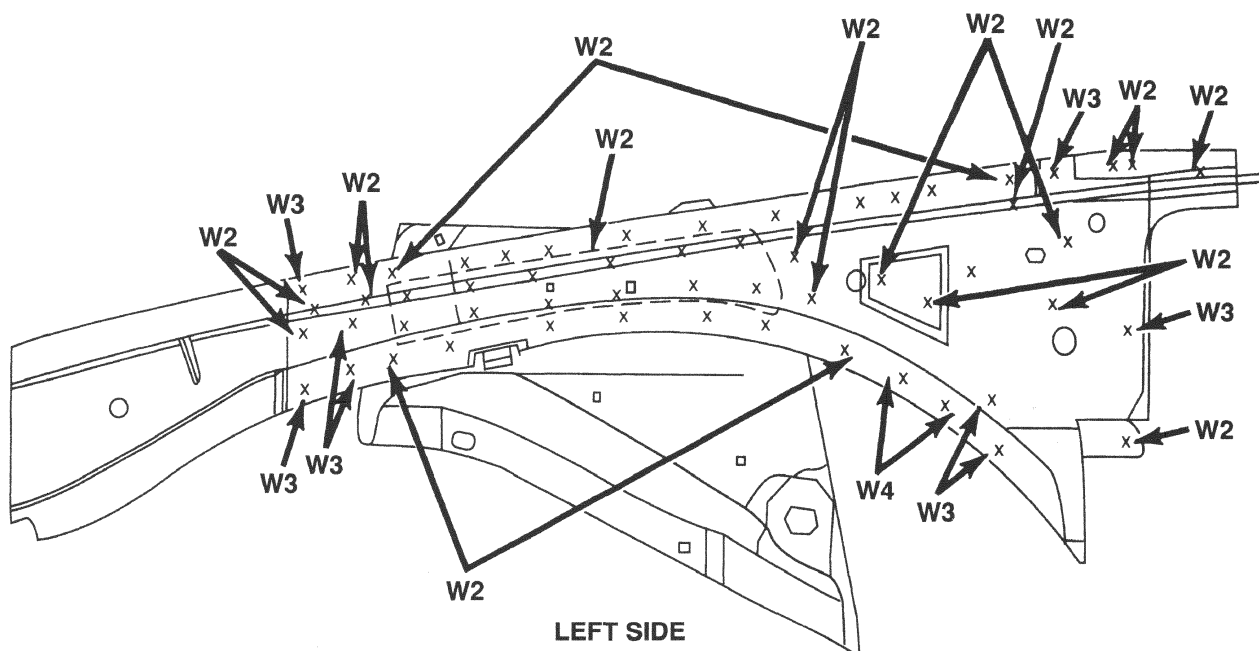






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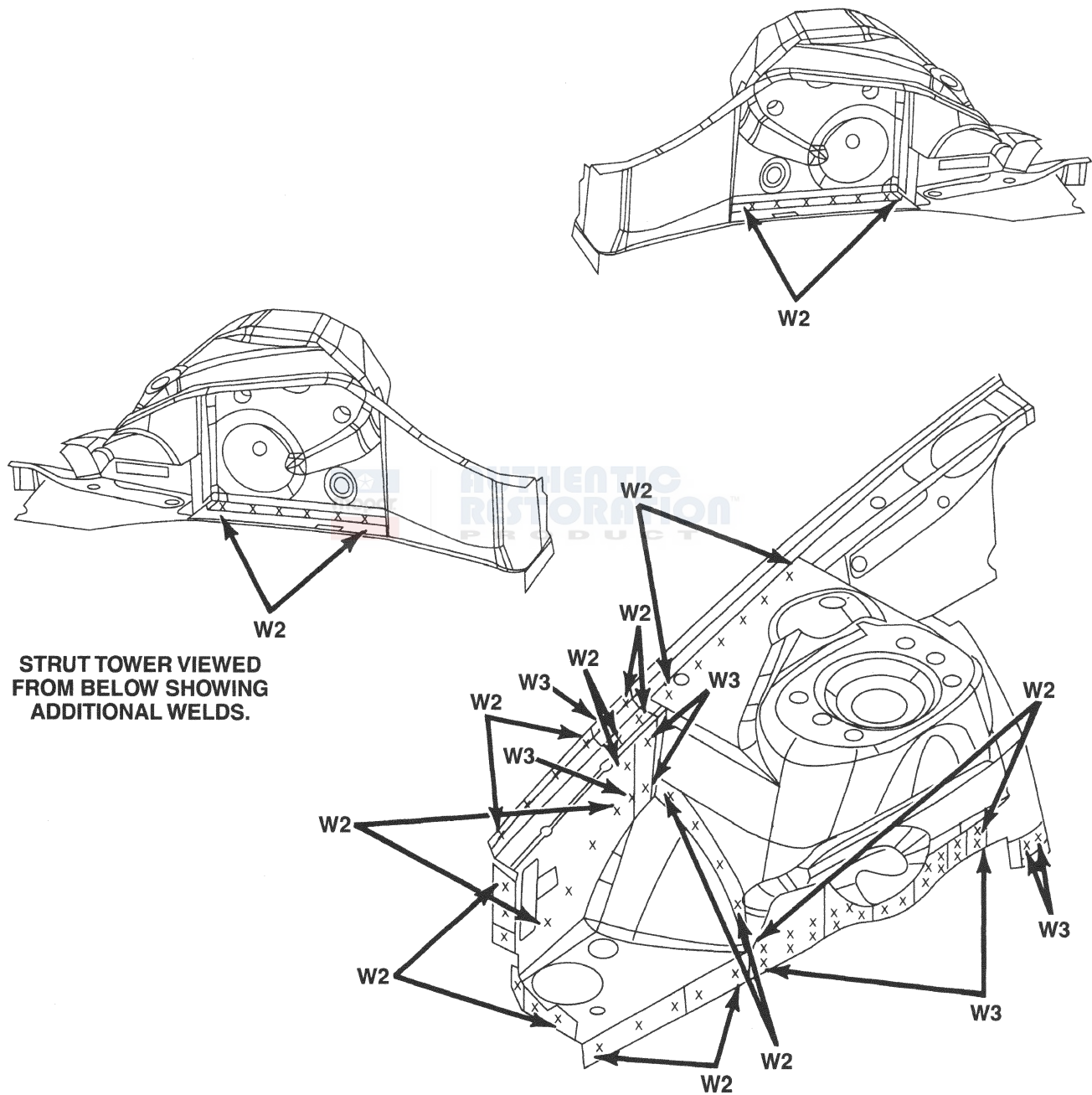
## UPPER LOAD PATH BEAM - INNER



W2 - WELDING OF 2 PARTS  
W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS

### SPECIFICATIONS (Continued)

## FENDER SIDE SHIELD AND STRUT TOWER

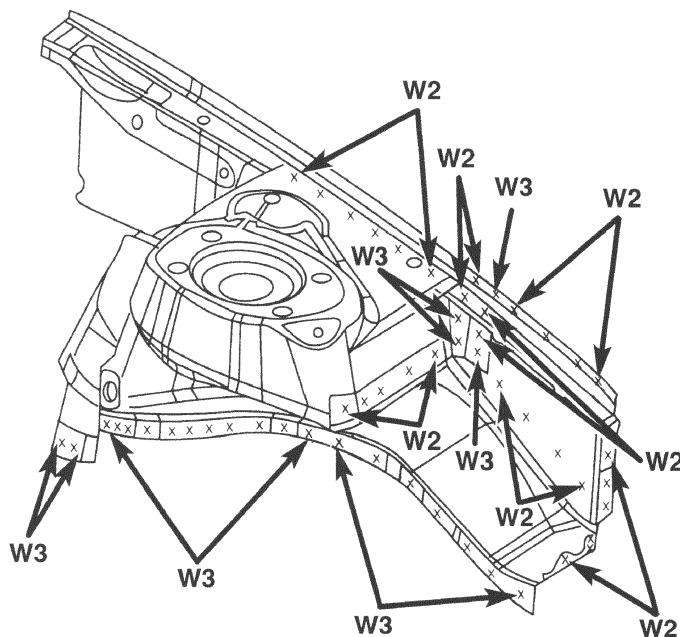
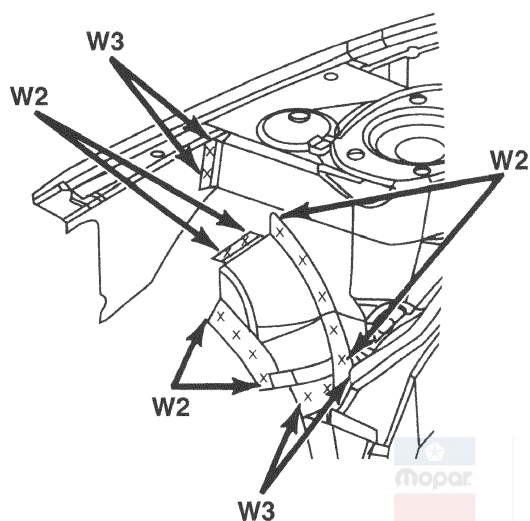


W2 - WELDING OF 2 PARTS  
W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS

## SPECIFICATIONS (Continued)

## FENDER SIDE SHIELD AND STRUT TOWER

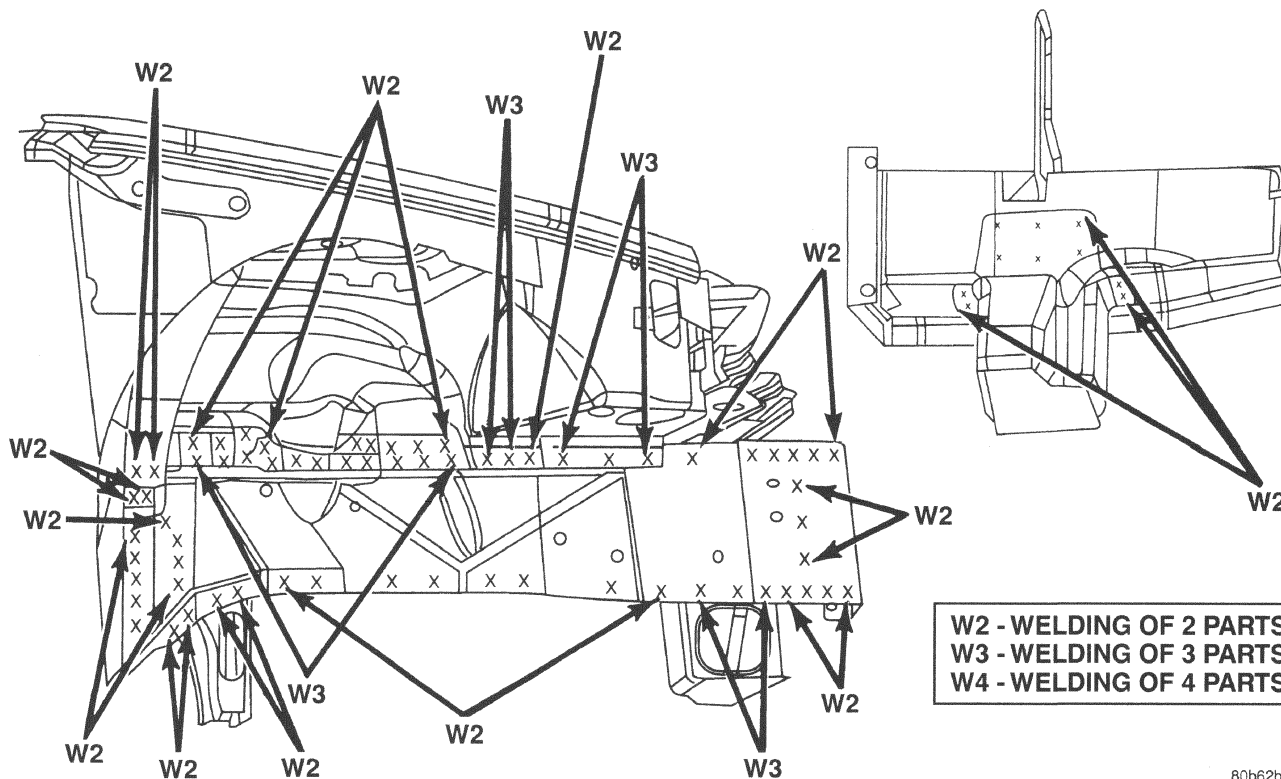
W2 - WELDING OF 2 PARTS  
W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS



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## FRONT LOWER SIDE RAIL AND EXTENSION



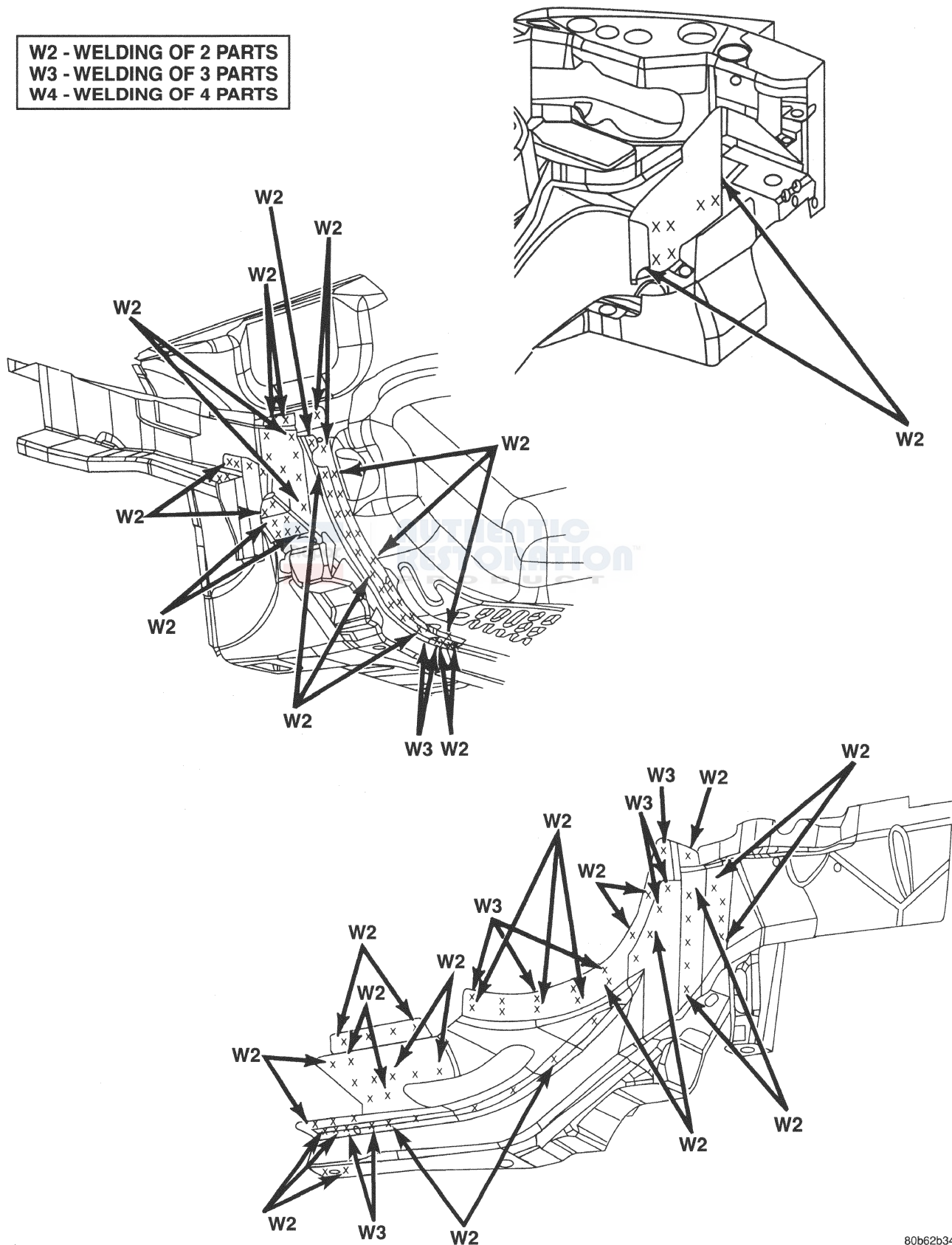
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W4 - WELDING OF 4 PARTS

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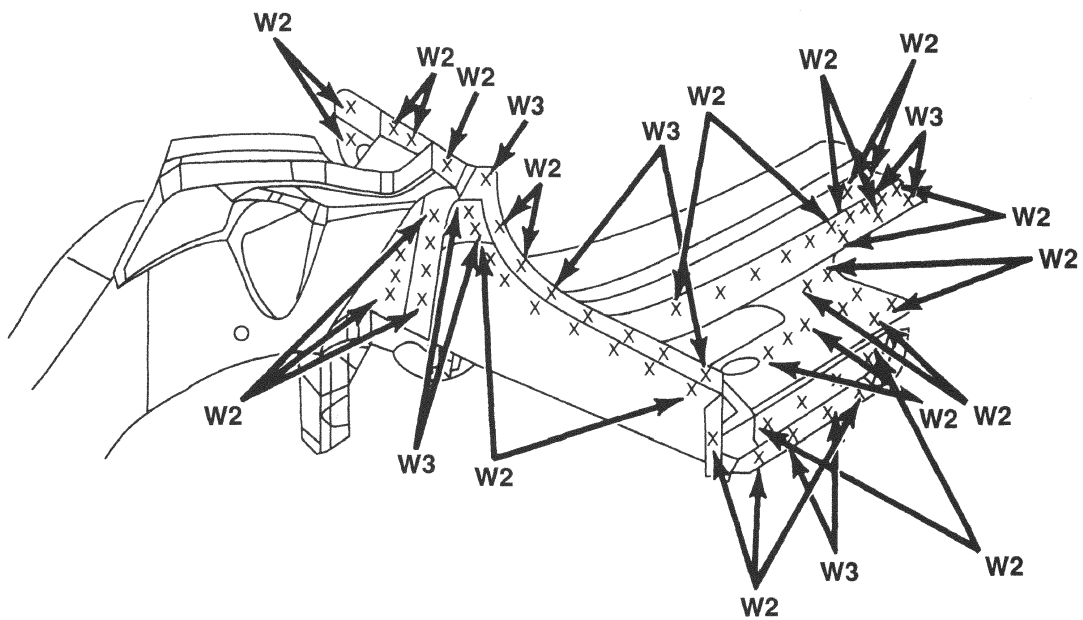
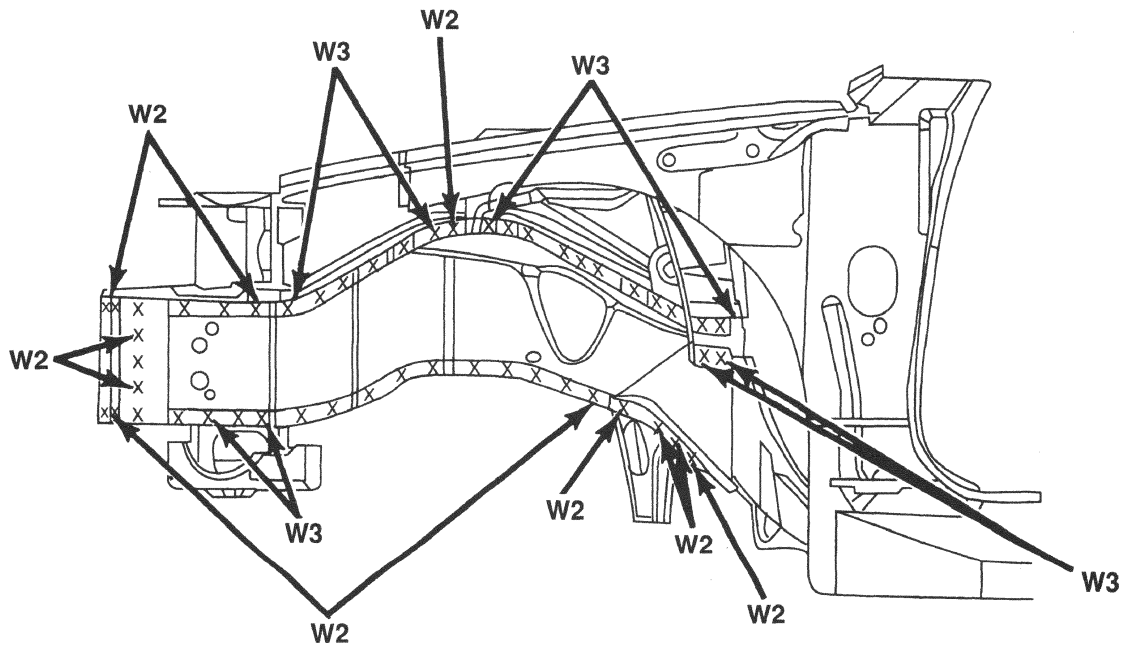
## SPECIFICATIONS (Continued)

## FRONT LOWER SIDE RAIL AND EXTENSION

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W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS



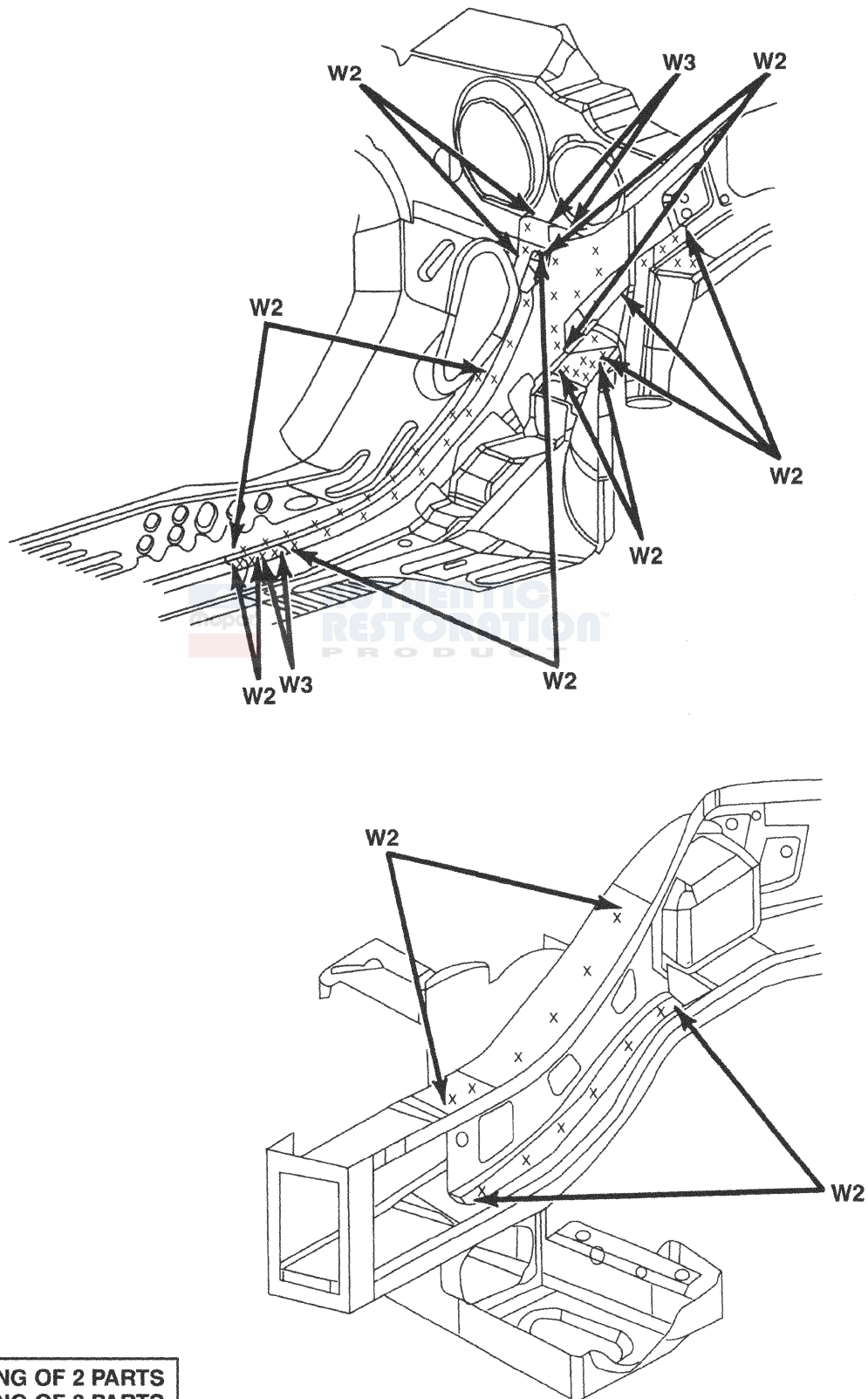


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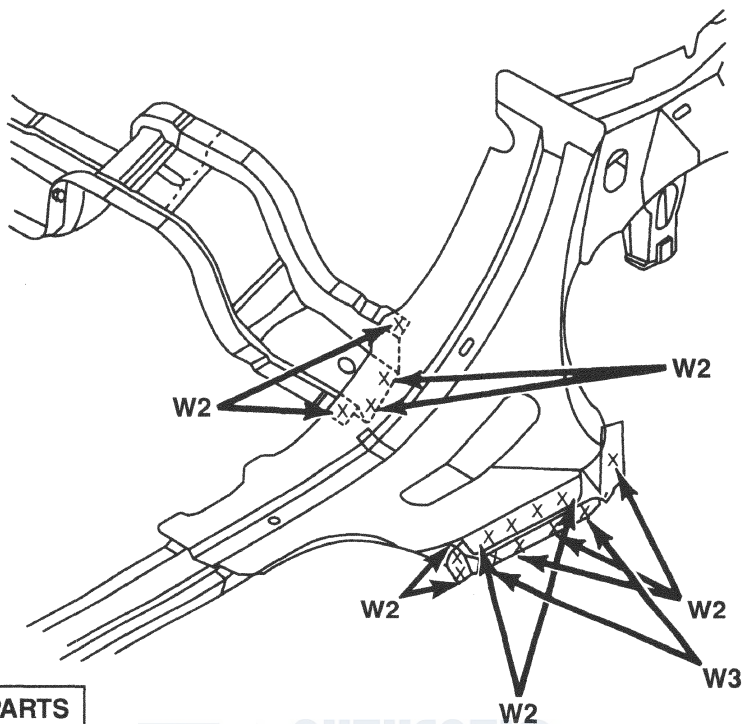
W2 - WELDING OF 2 PARTS  
W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS

## SPECIFICATIONS (Continued)

## FRONT LOWER SIDE RAIL AND EXTENSION



W2 - WELDING OF 2 PARTS  
W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS

**SPECIFICATIONS (Continued)****FRONT LOWER SIDE RAIL AND EXTENSION**

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W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS

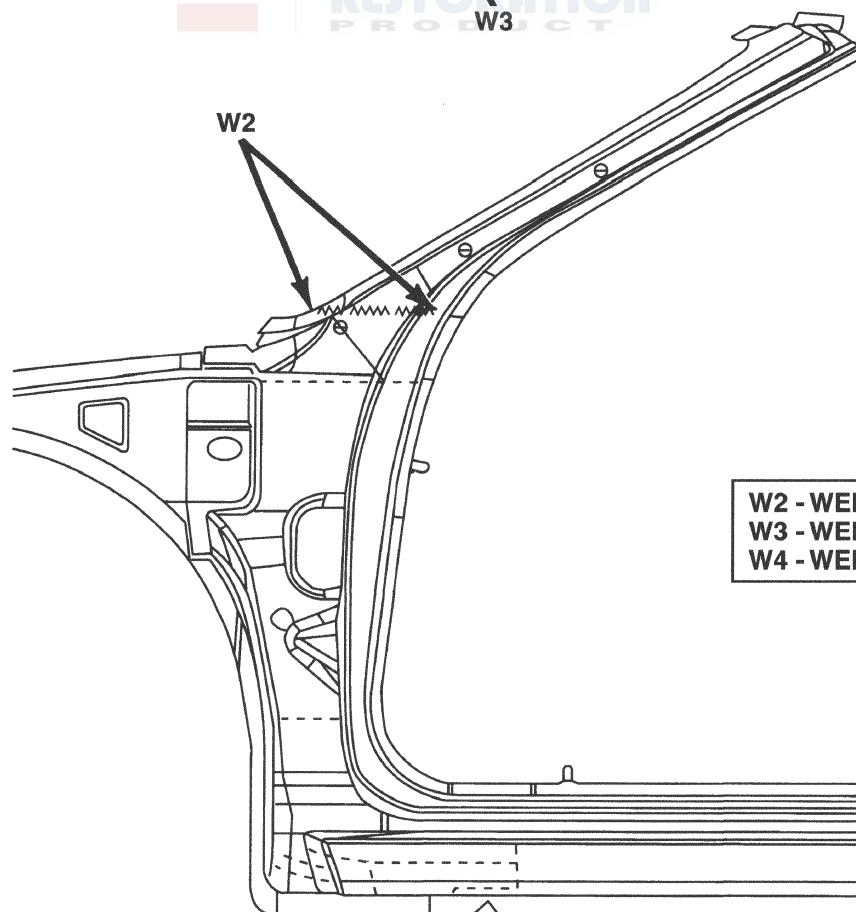
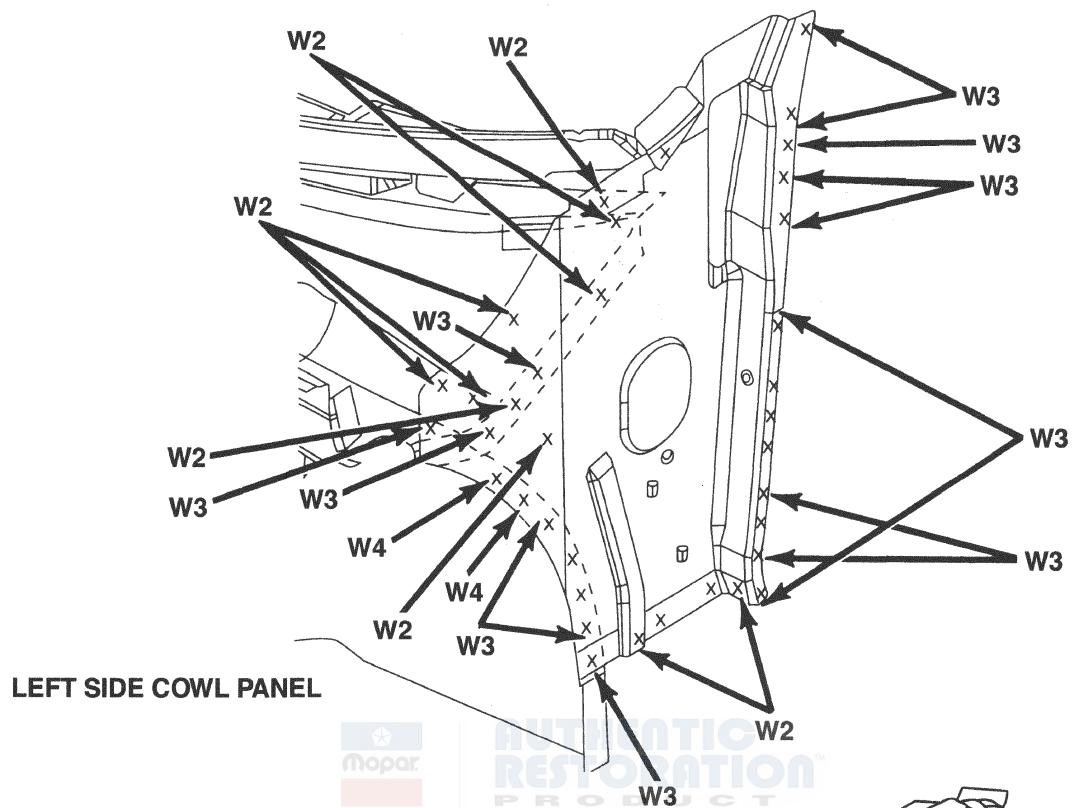


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## SPECIFICATIONS (Continued)

## COWL SIDE PANEL



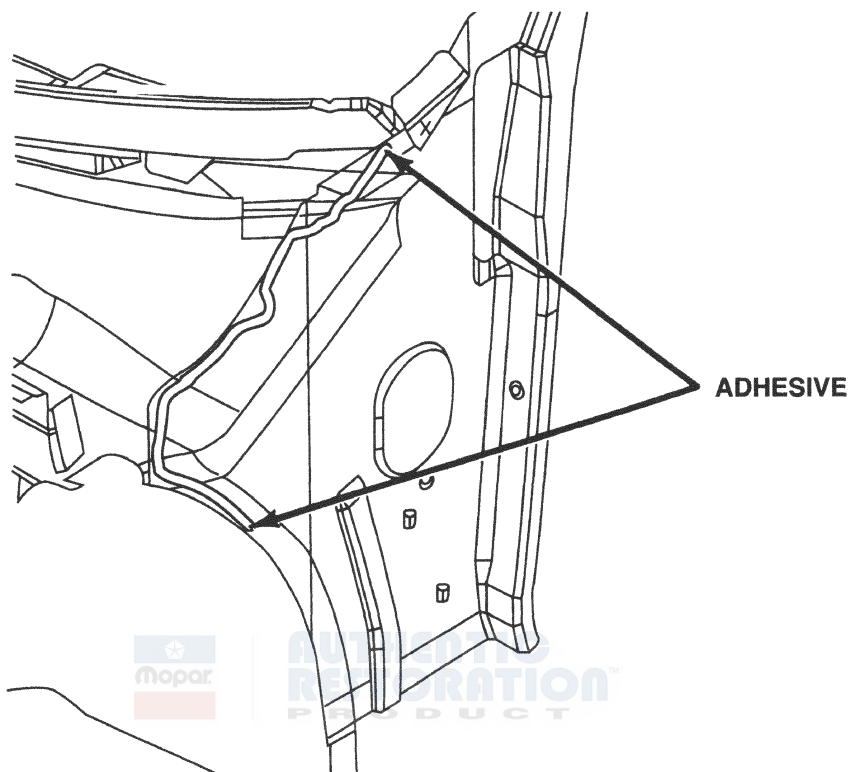
W2 - WELDING OF 2 PARTS  
W3 - WELDING OF 3 PARTS  
W4 - WELDING OF 4 PARTS



**SPECIFICATIONS (Continued)**

**STRUCTURAL ADHESIVE LOCATIONS**

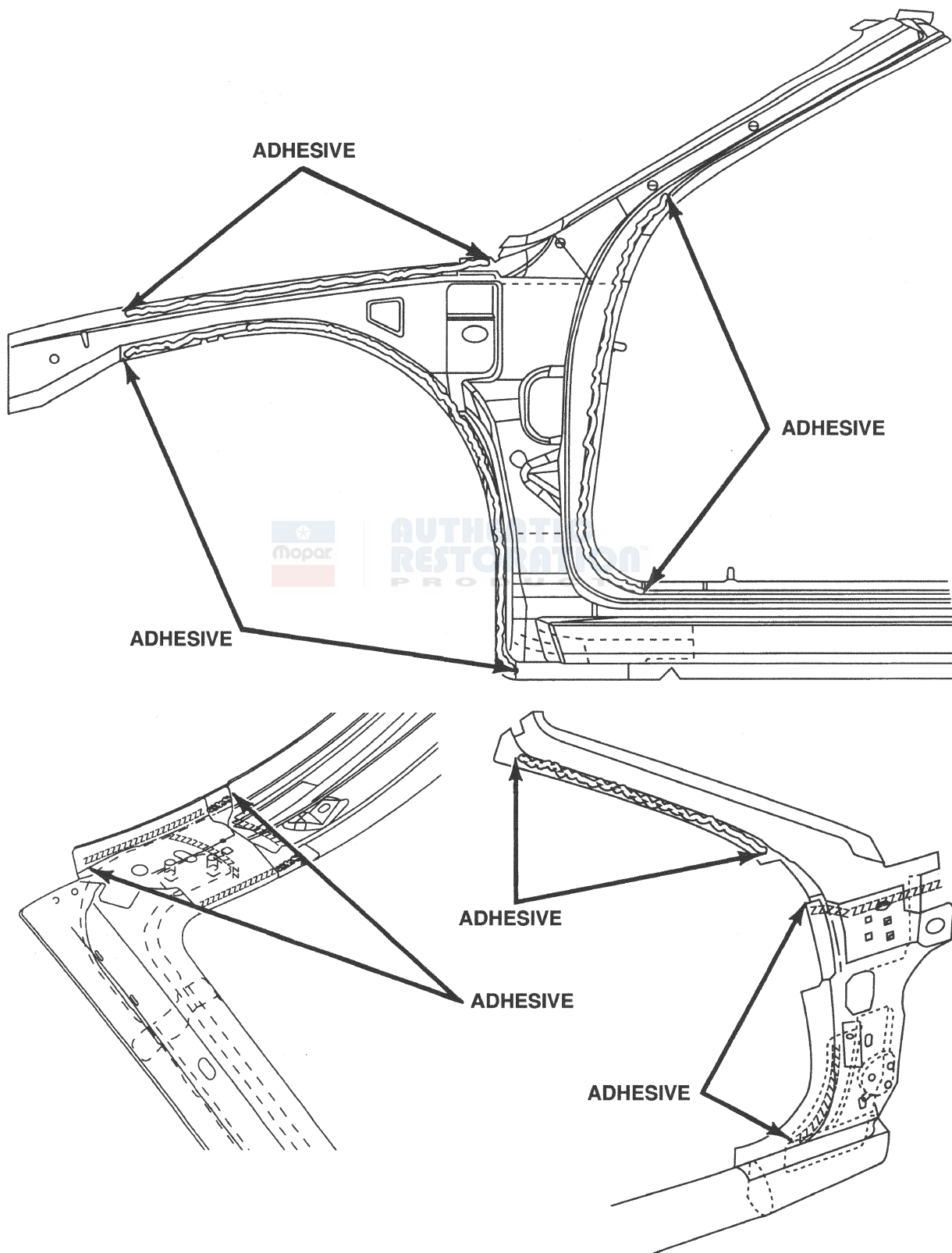
**COWL AREA**

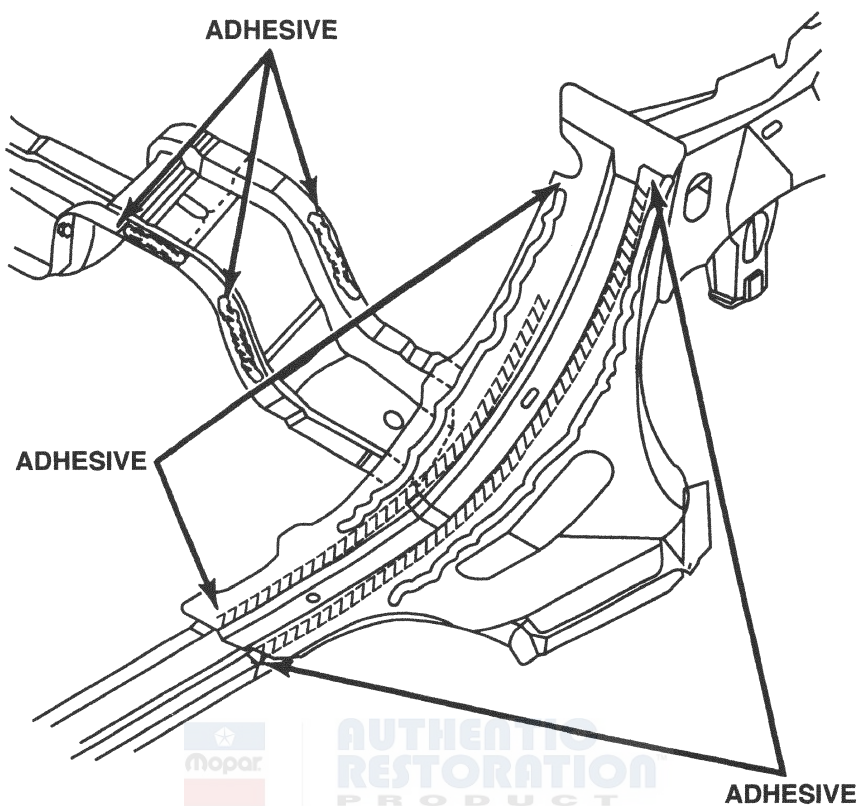


80b62bc2

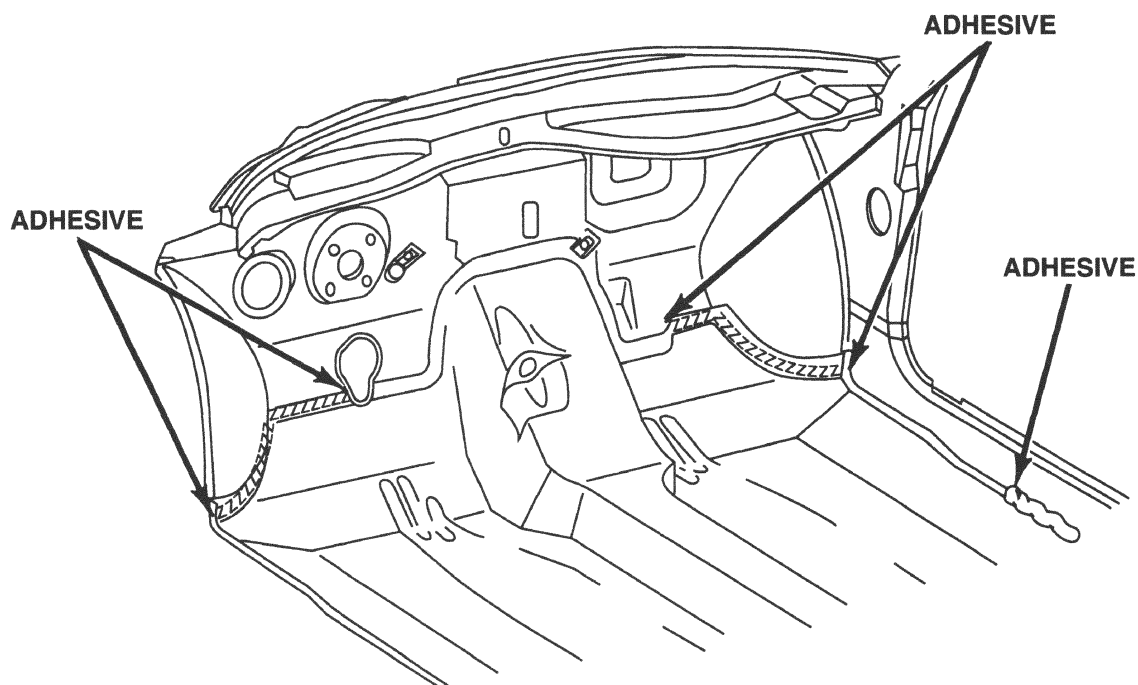
**SPECIFICATIONS (Continued)**

**WINDSHIELD PILLAR AREA**



**SPECIFICATIONS (Continued)****FRONT FRAME AREA**

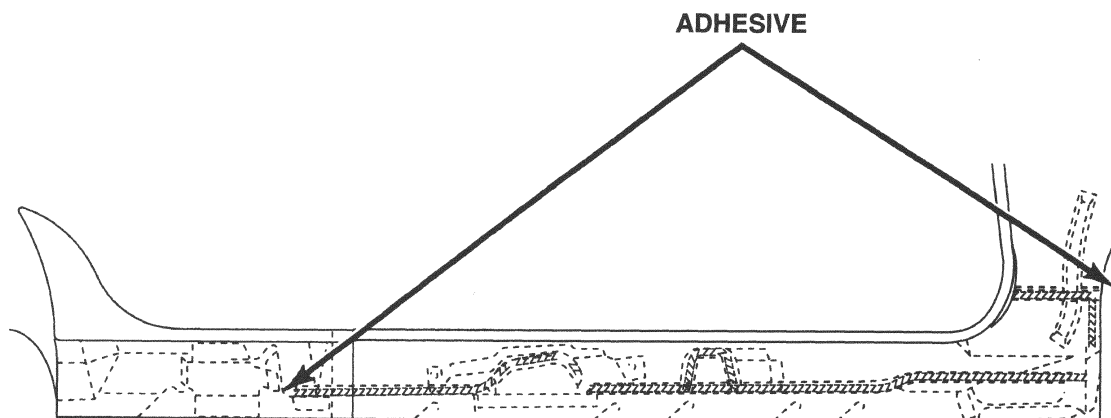
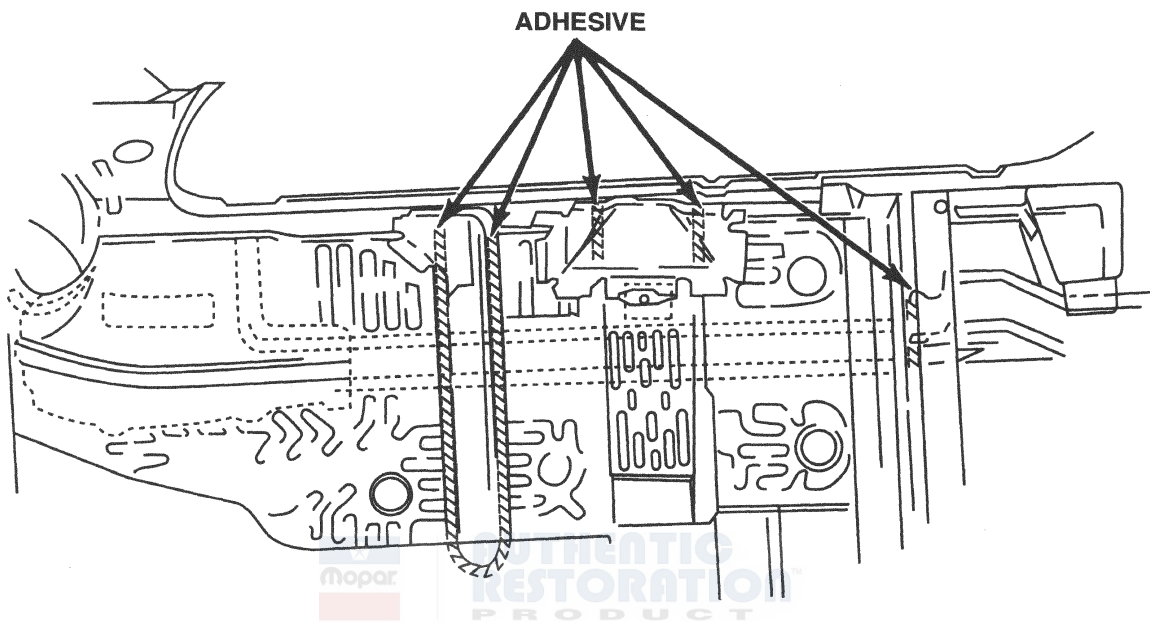
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**FRONT FRAME AREA**

80b62bc4

## SPECIFICATIONS (Continued)

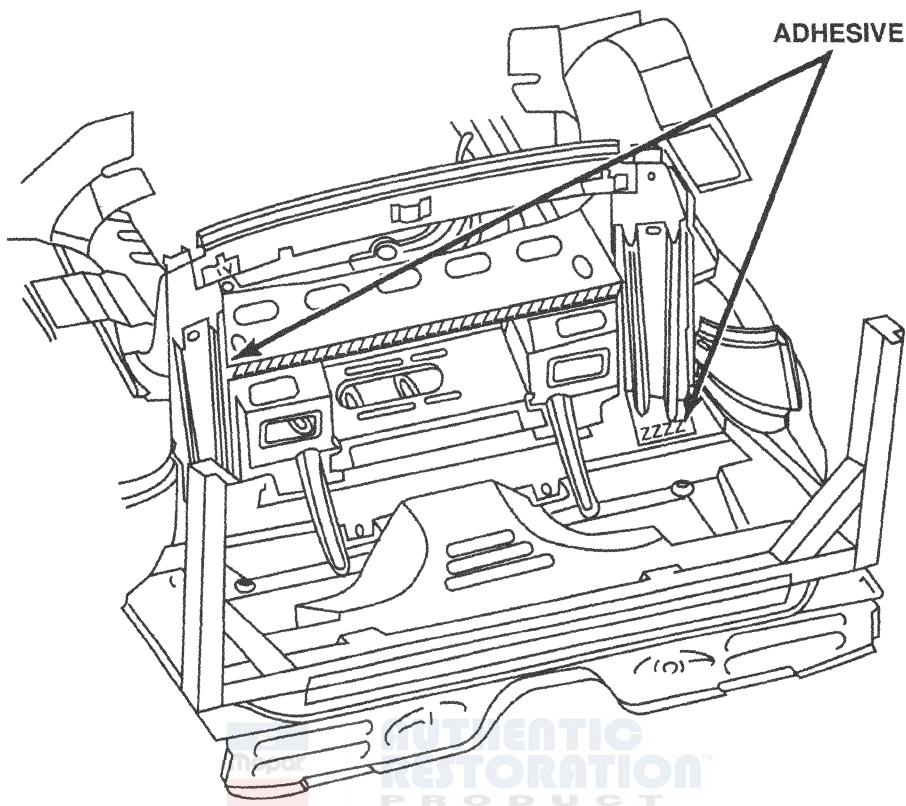
## FRONT FRAME AREA





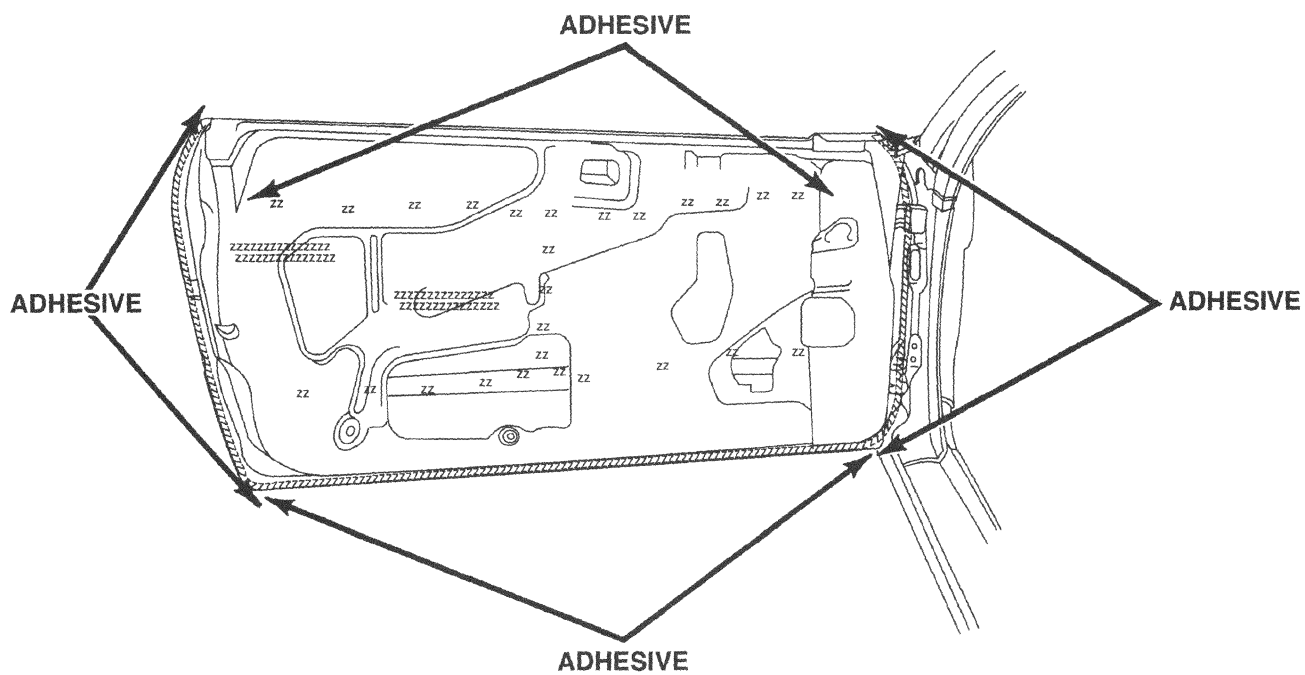
**SPECIFICATIONS (Continued)**

**REAR FLOOR AREA**



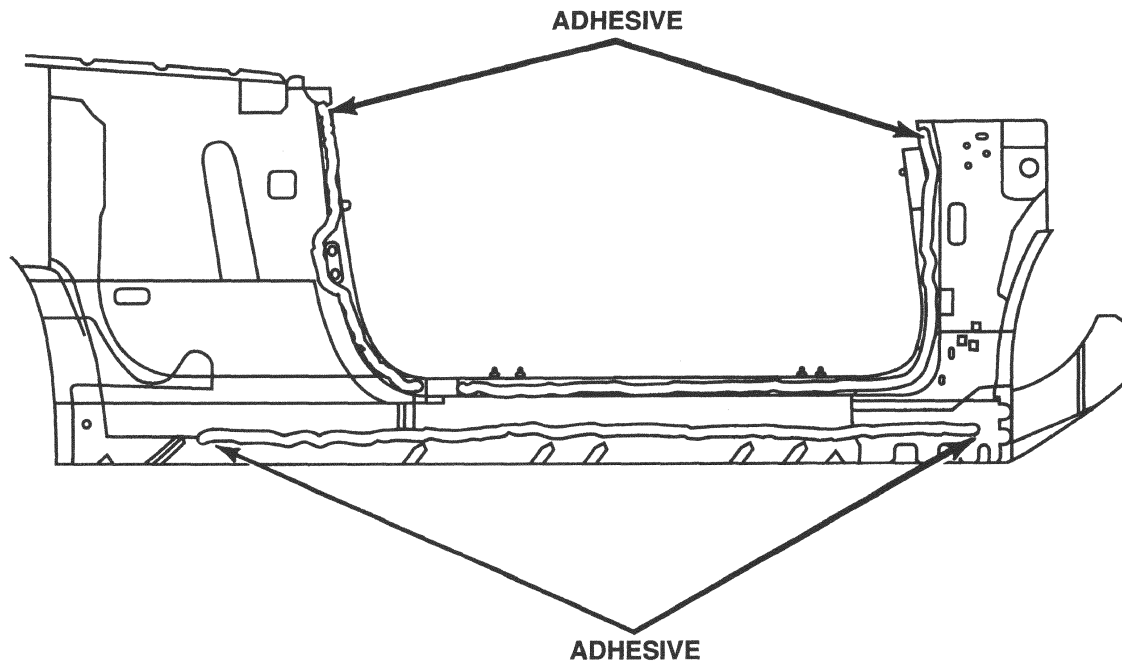
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**DOORS**



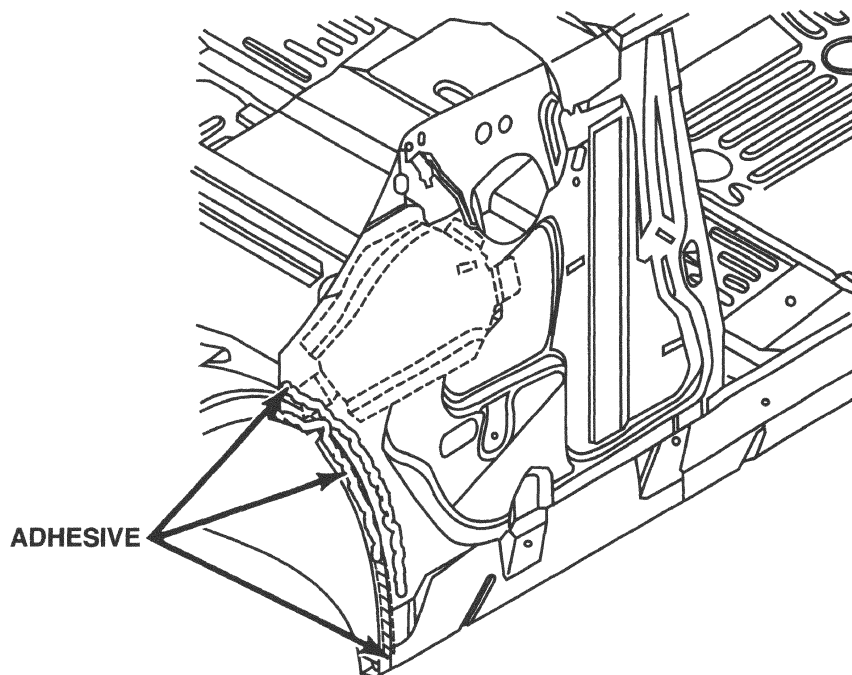
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## SPECIFICATIONS (Continued)

**BODY SIDE APERTURE AREA**

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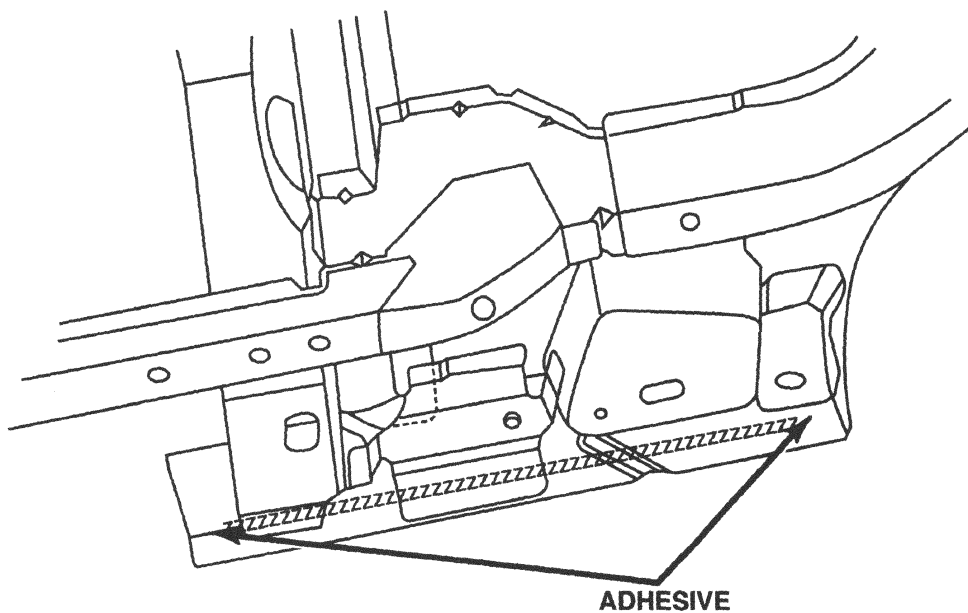
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**INNER QUARTER AREA**

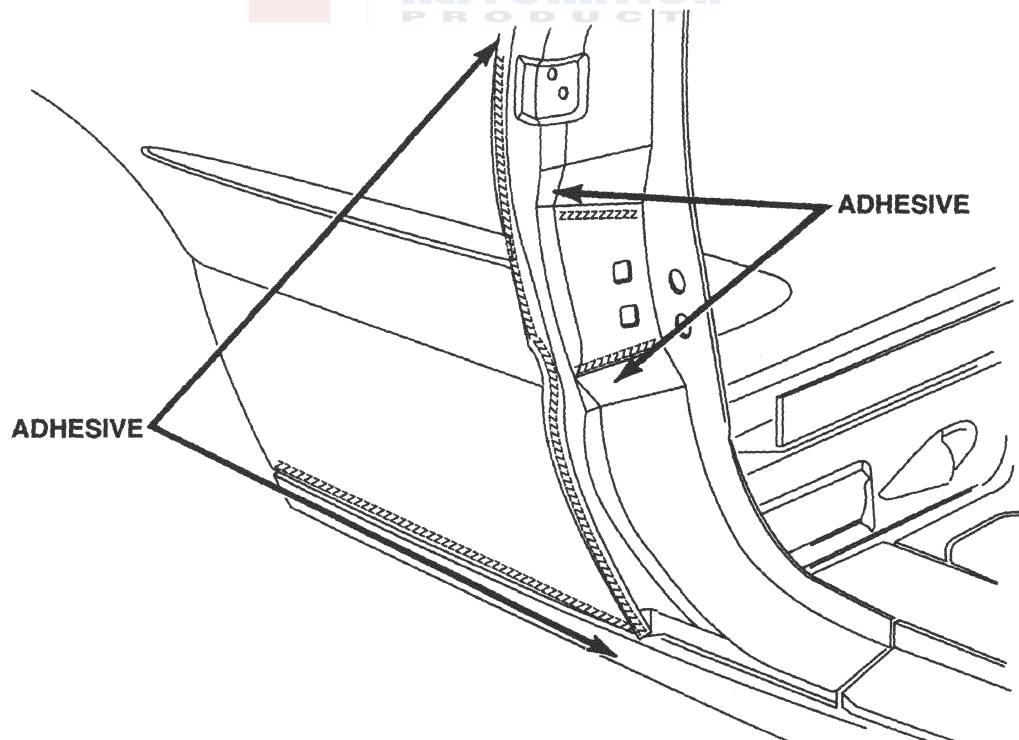
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## SPECIFICATIONS (Continued)

## LOWER QUARTER AREA

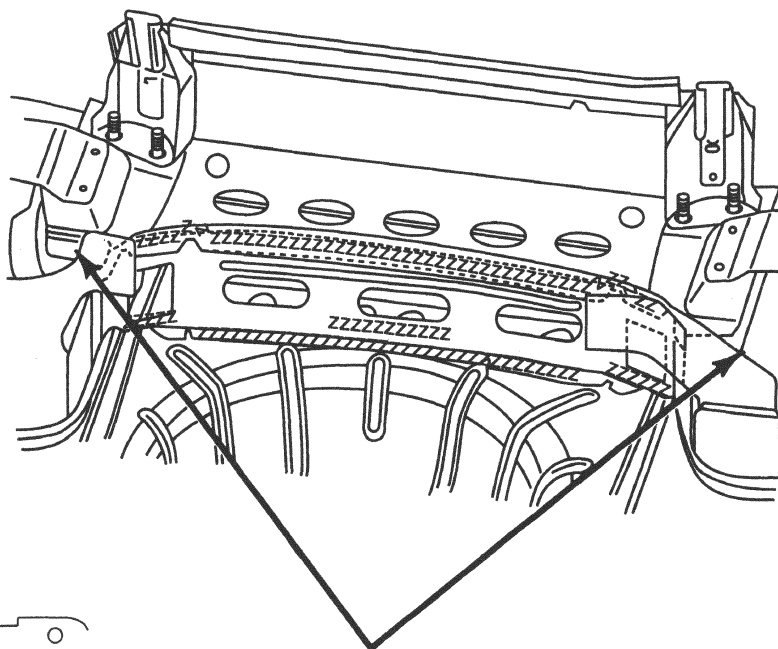


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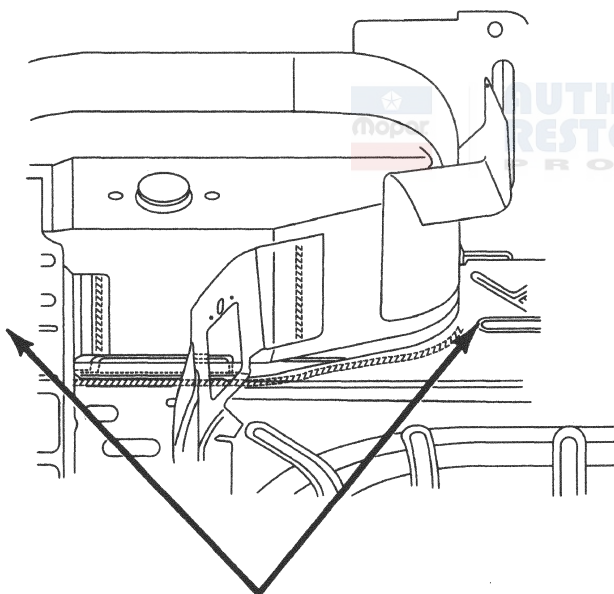


## SPECIFICATIONS (Continued)

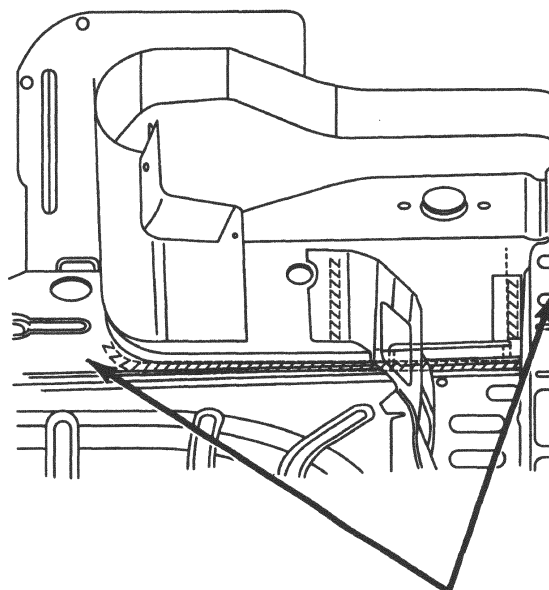
## FORWARD TRUNK AREA



ADHESIVE



ADHESIVE

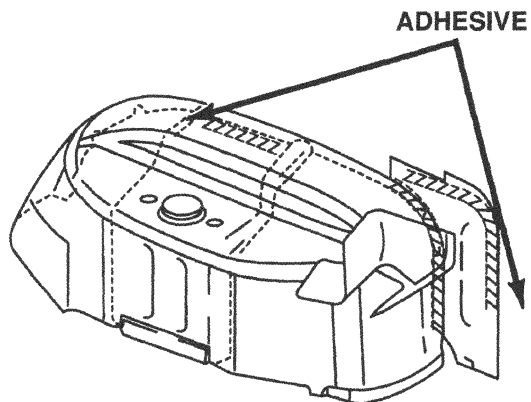
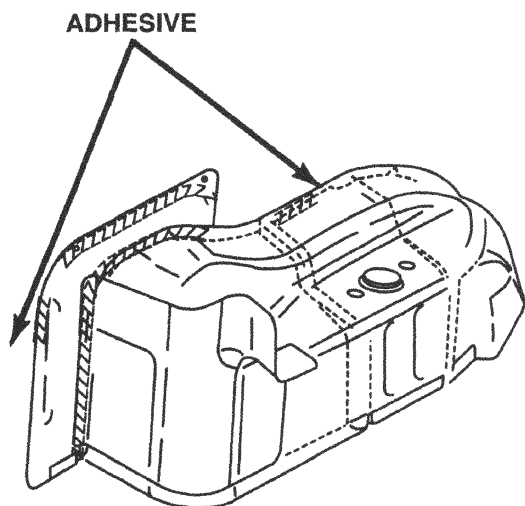


ADHESIVE



**SPECIFICATIONS (Continued)**

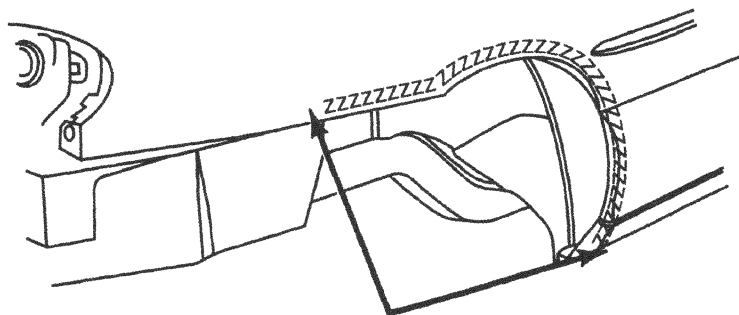
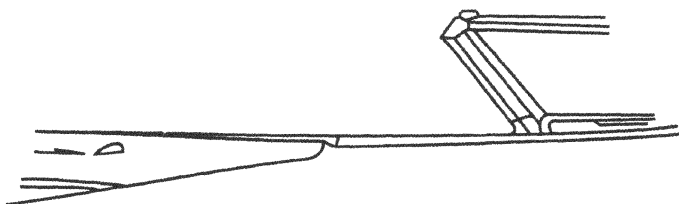
**REAR INNER WHEELHOUSE**



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RESTORATION**

80b62be5

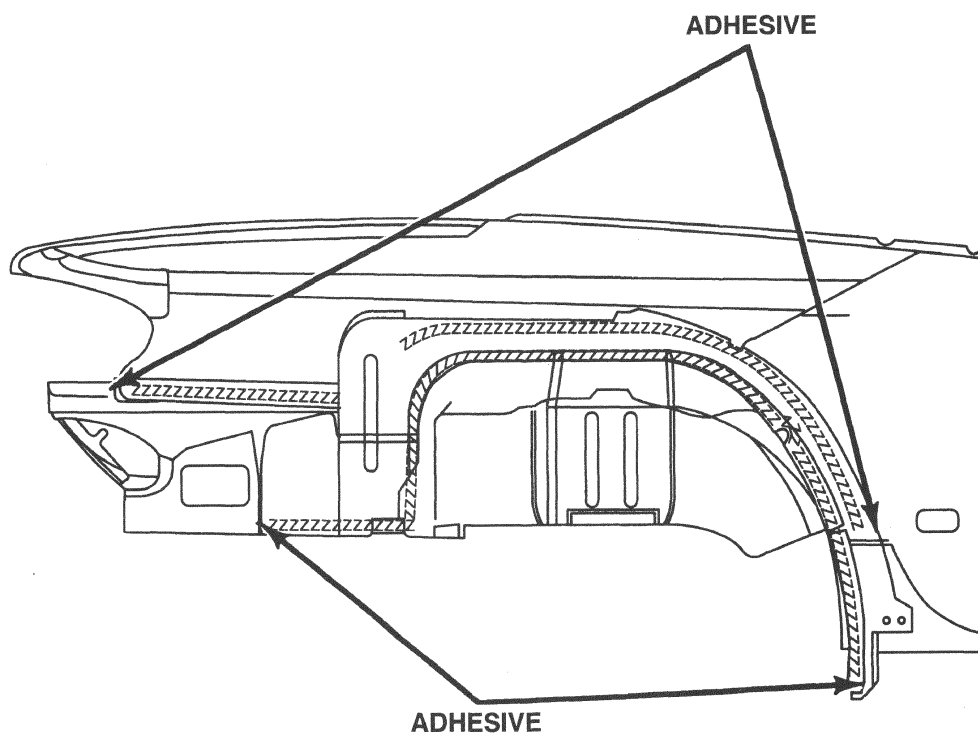
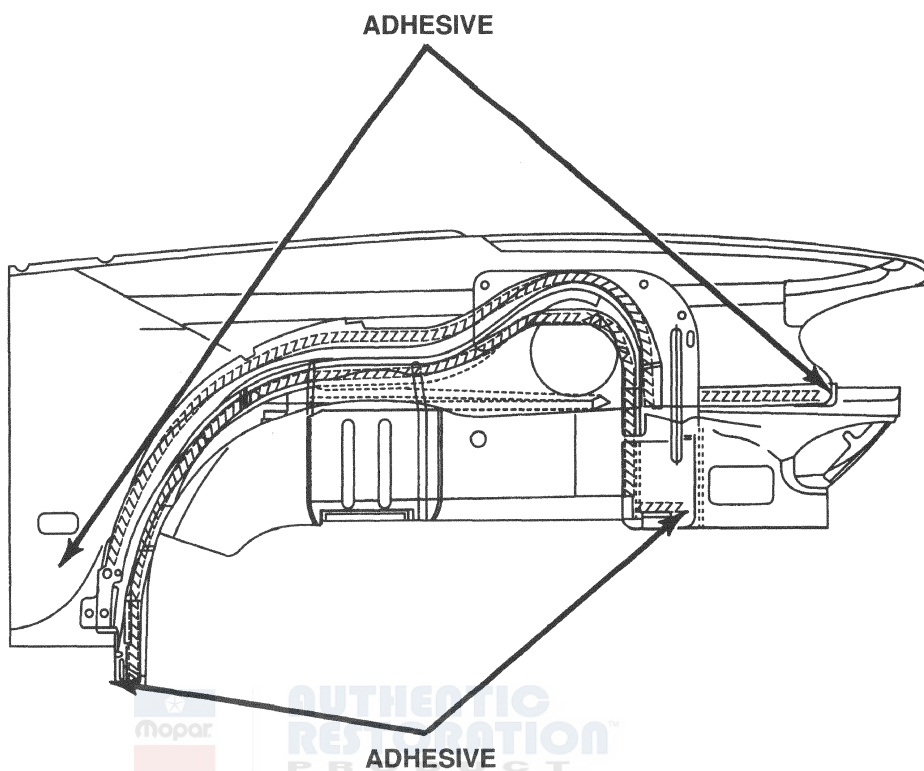
**QUARTER PANEL AREA**

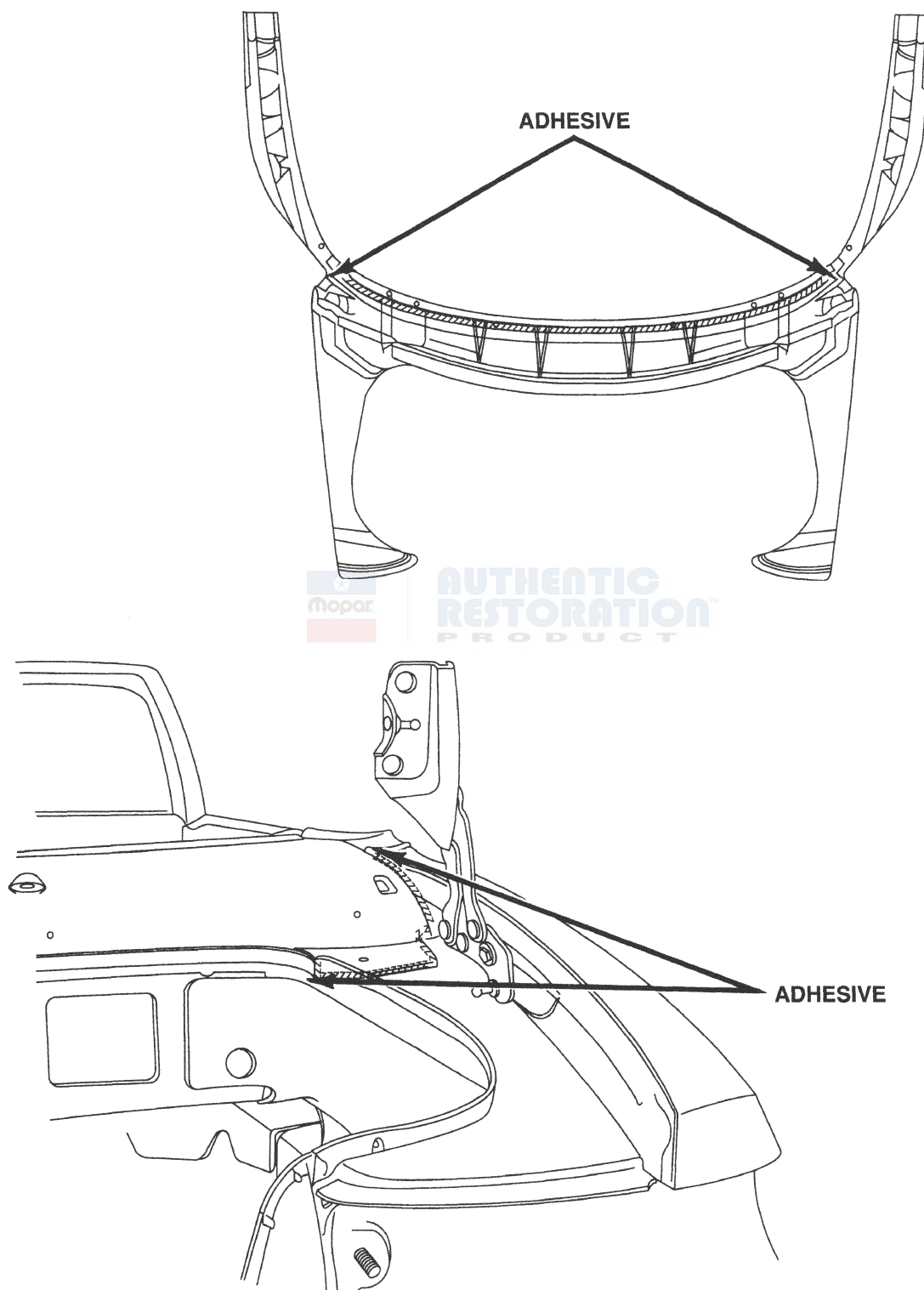


80b62bca

**SPECIFICATIONS (Continued)**

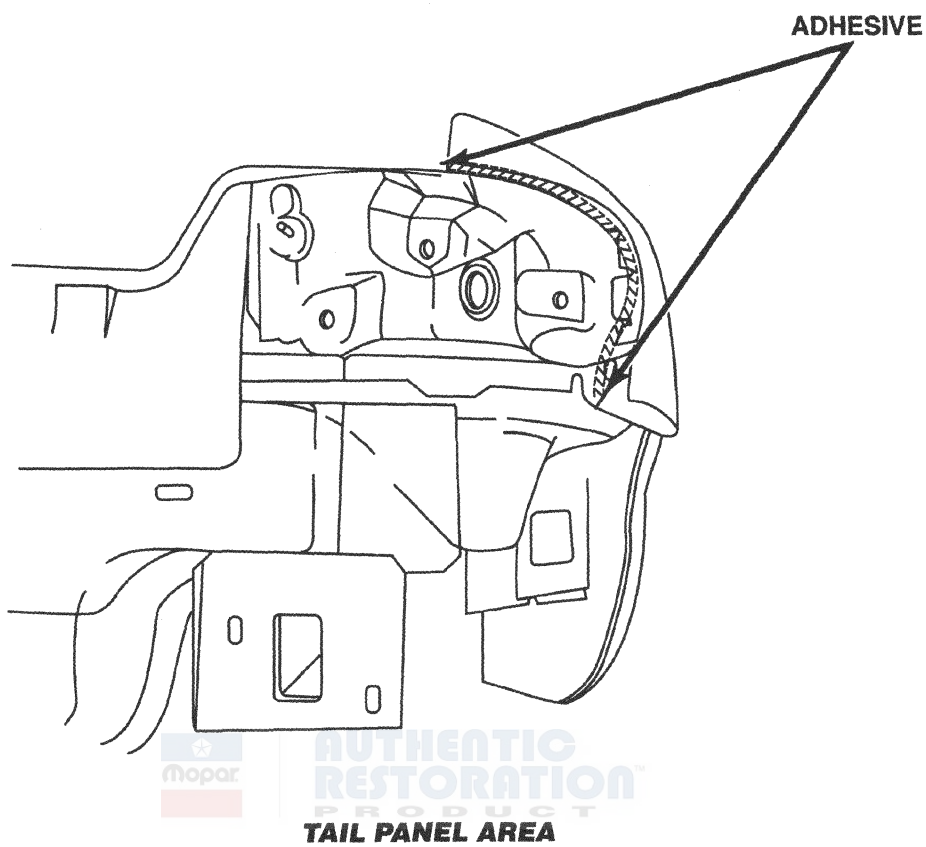
**OUTER WHEELHOUSE AREA**



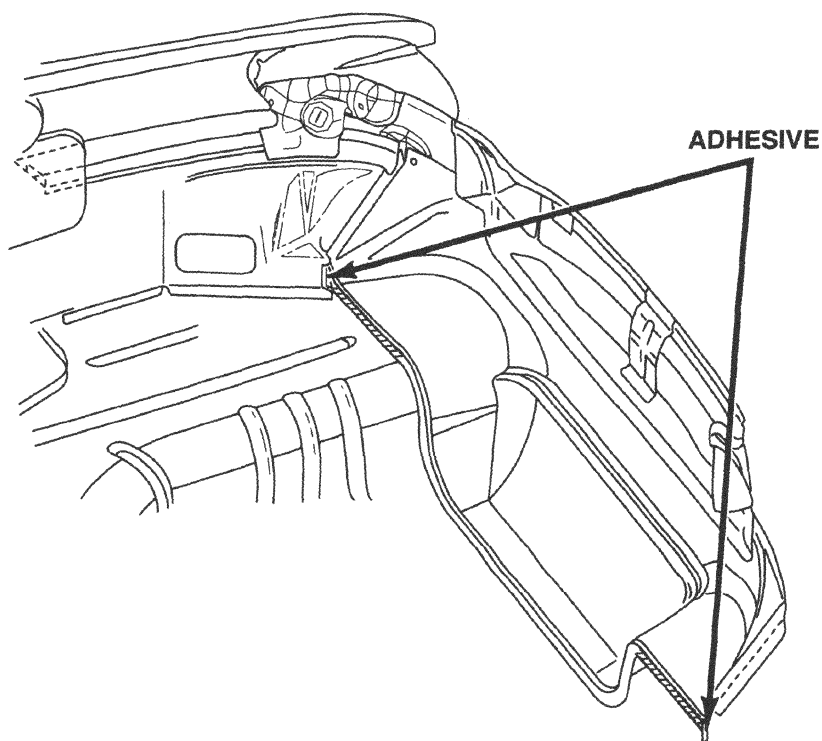
**SPECIFICATIONS (Continued)****TRUNK OPENING AREA**

## SPECIFICATIONS (Continued)

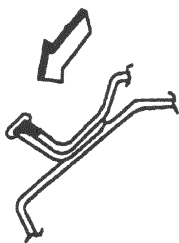
## TAIL LAMP AREA



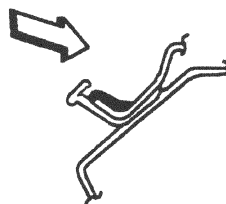
## TAIL PANEL AREA



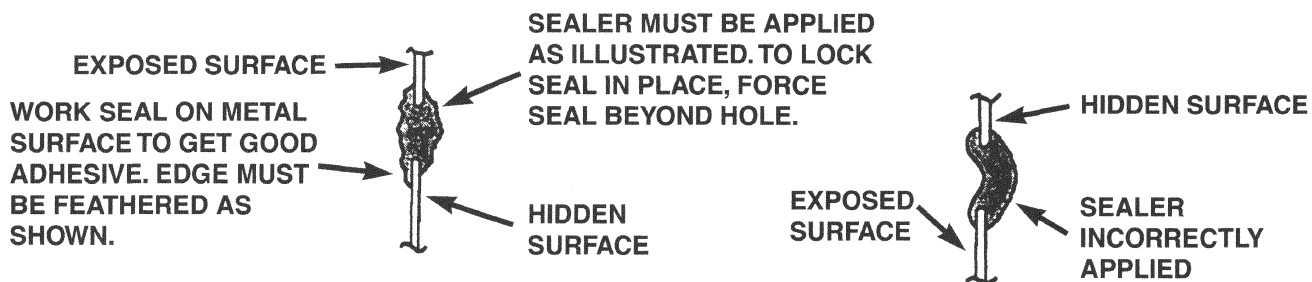
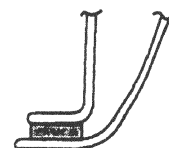
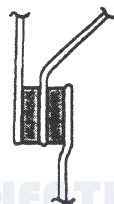


**SPECIFICATIONS (Continued)****SEALER LOCATIONS****METHODS OF APPLYING AUTO BODY SEALANT**

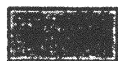
HOLD GUN NOZZLE IN DIRECTION OF ARROW IN ORDER TO EFFECTIVELY SEAL METAL JOINTS.



DO NOT HOLD GUN NOZZLE IN DIRECTION OF ARROW. SEALER APPLIED AS SHOWN IN INEFFECTIVE.

**SYMBOLS**

THUMBGRADEABLE SEALER



EXTRUDABLE THERMOPLASTIC



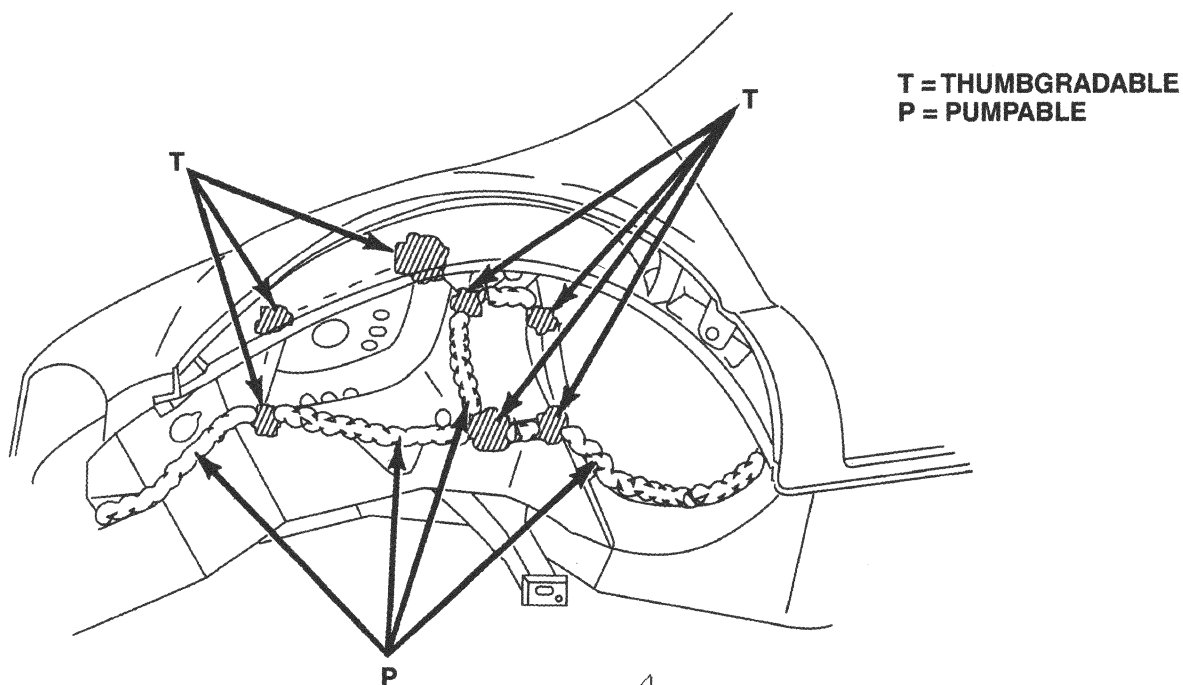
EXPOSED THERMOPLASTIC SEALANT



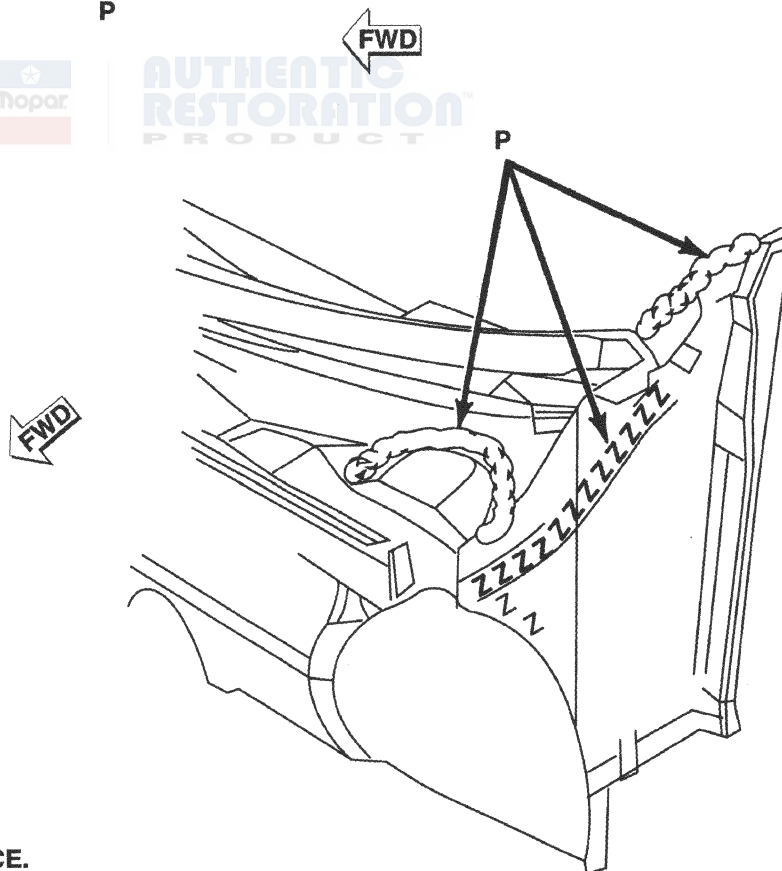
HIDDEN SEALANT

**SPECIFICATIONS (Continued)**

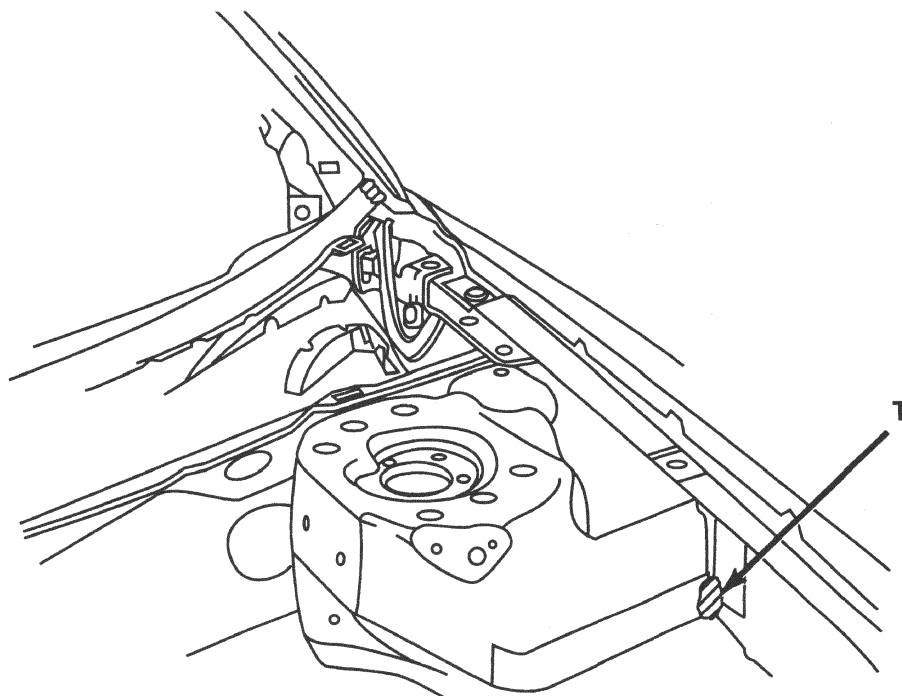
**STRUT TOWER AND COWL AREA**



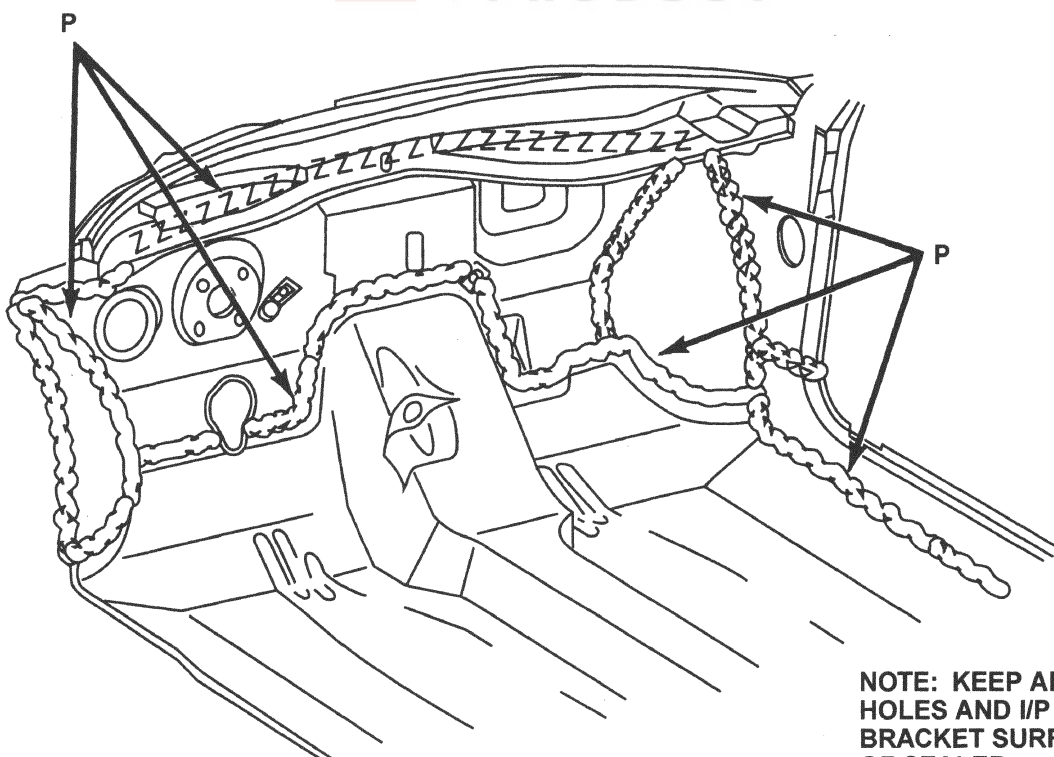
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**NOTE: KEEP SEALER OFF  
WINDSHIELD SEALING SURFACE.  
SEALER MUST PROVIDE A SMOOTH  
TRANSITION TO WINDSHIELD  
SEALING SURFACE.**

**SPECIFICATIONS (Continued)****STRUT TOWER AND COWL AREA****AUTHENTIC  
RESTORATION  
PRODUCT**

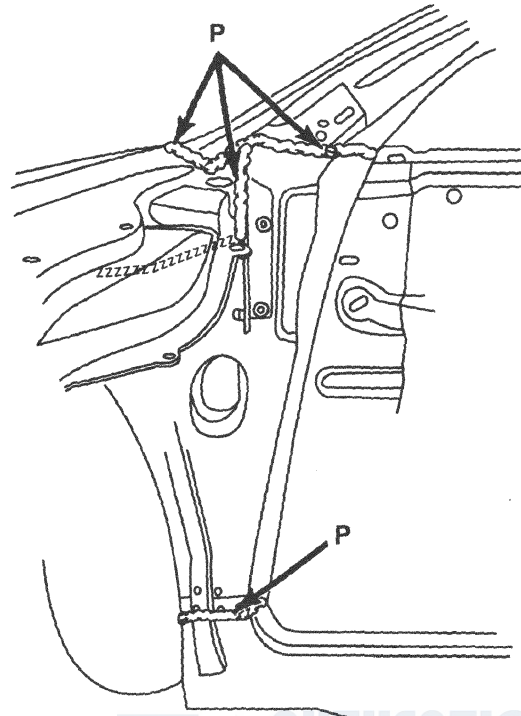
T = THUMBGRADABLE  
P = PUMPABLE



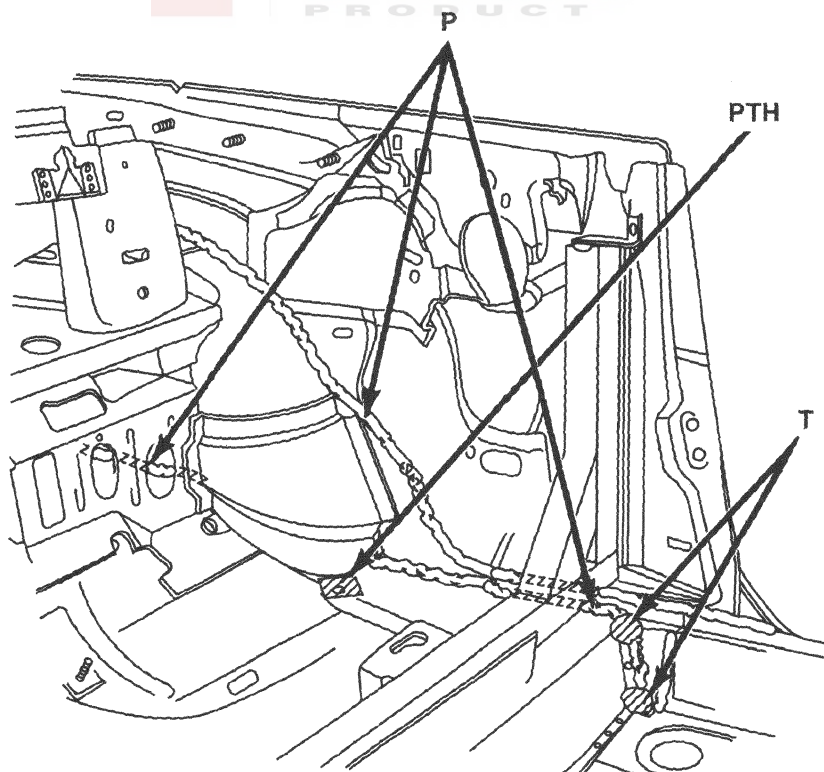
**NOTE: KEEP ALL ACCESS  
HOLES AND I/P MOUNTING  
BRACKET SURFACES FREE  
OF SEALER.**

## SPECIFICATIONS (Continued)

## BODY SIDE APERTURE



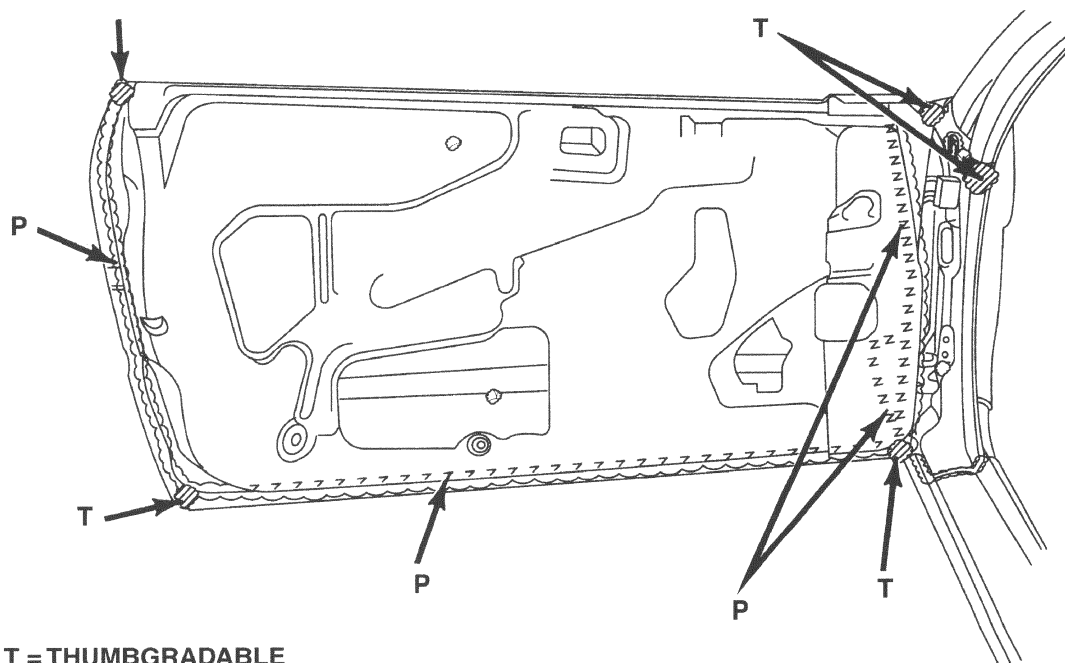
T = THUMBGRADABLE  
P = PUMPABLE  
PTH = PATCH





## SPECIFICATIONS (Continued)

## DOORS



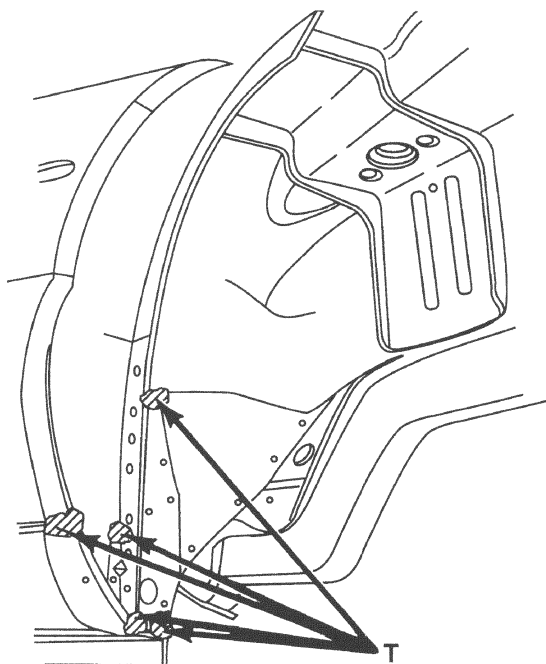
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P = PUMPABLE



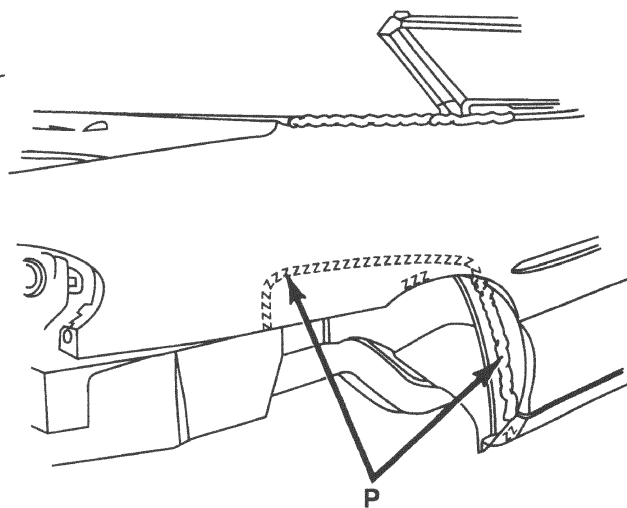
**AUTHENTIC  
RESTORATION  
PRODUCT**

80b62bd1

## INNER WHEELHOUSE AND REAR QUARTER PANEL



T = THUMBGRADABLE  
P = PUMPABLE

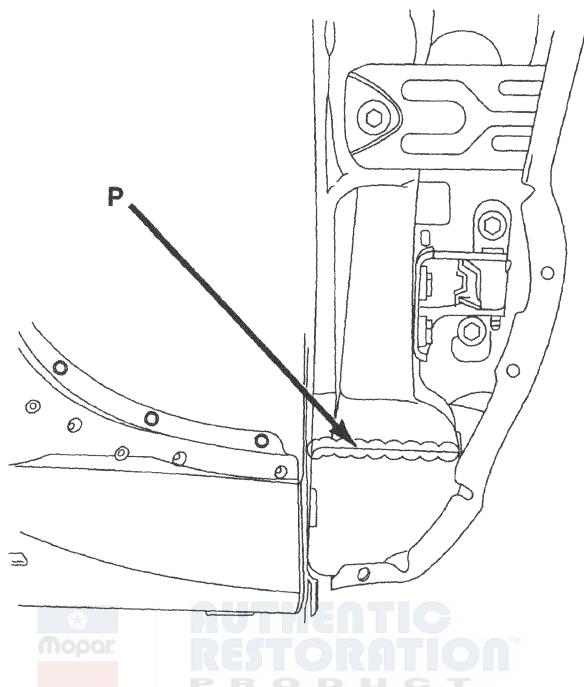


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**SPECIFICATIONS (Continued)**

**REAR OF FRONT FENDERWELL**

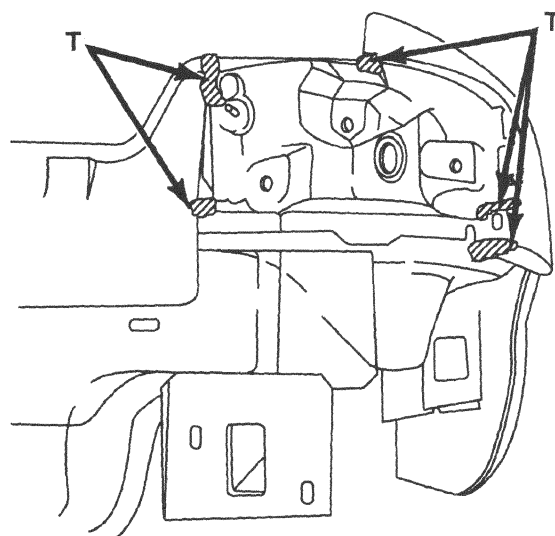
**P = PUMPABLE**



80b62bd2

## SPECIFICATIONS (Continued)

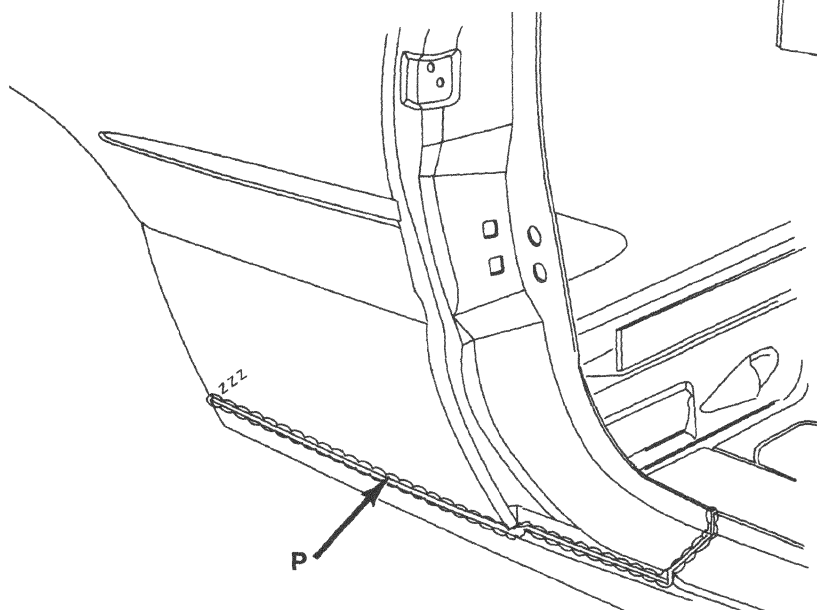
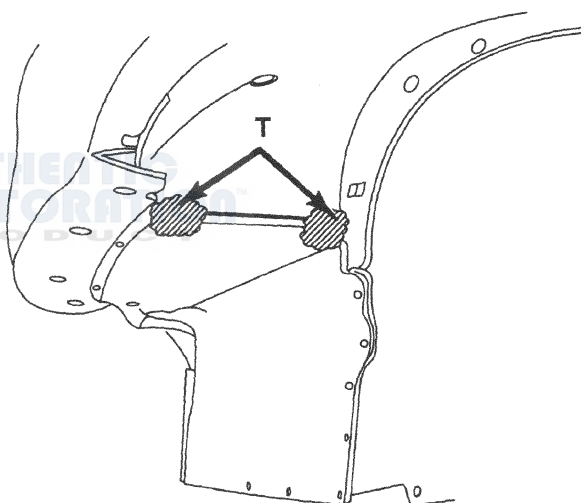
## REAR QUARTER PANEL AND TAIL LIGHT AREA



T = THUMBGRADABLE  
P = PUMPABLE

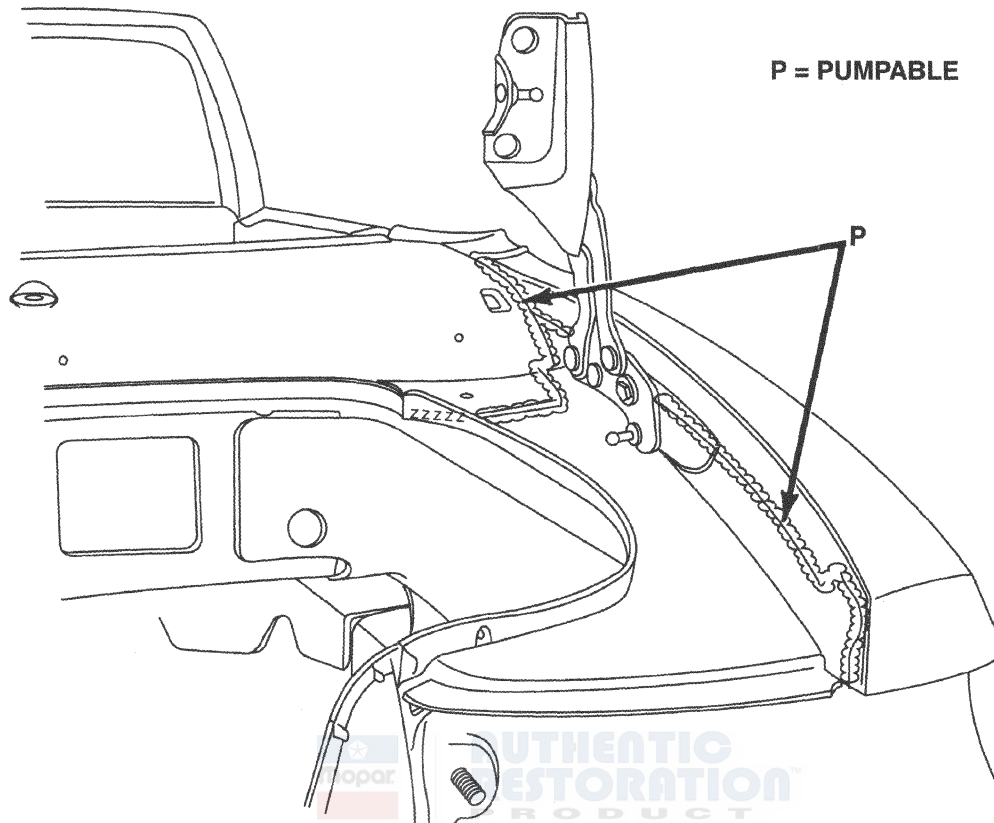


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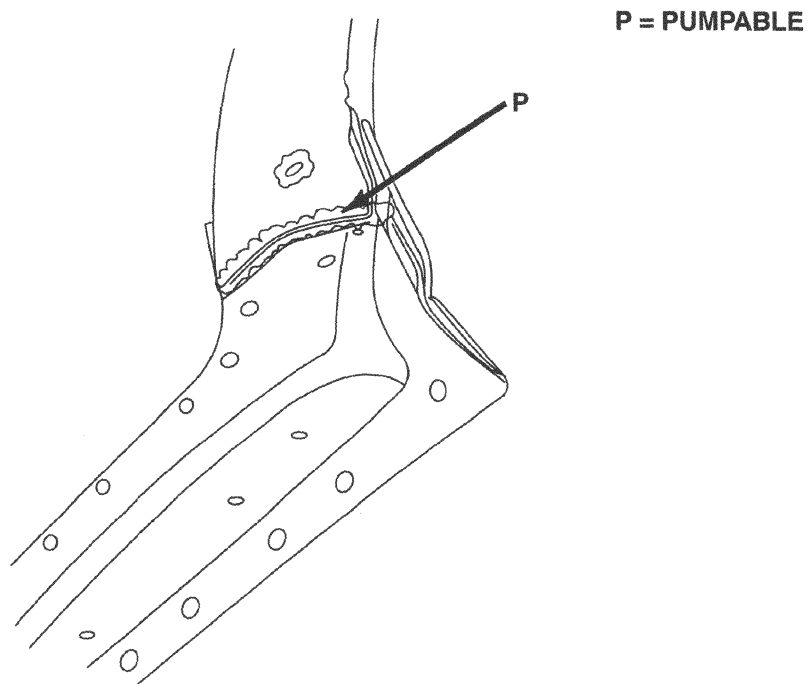
**SPECIFICATIONS (Continued)**

**REAR QUARTER PANEL AND TAIL LIGHT AREA**



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**WINDSHIELD PILLAR**

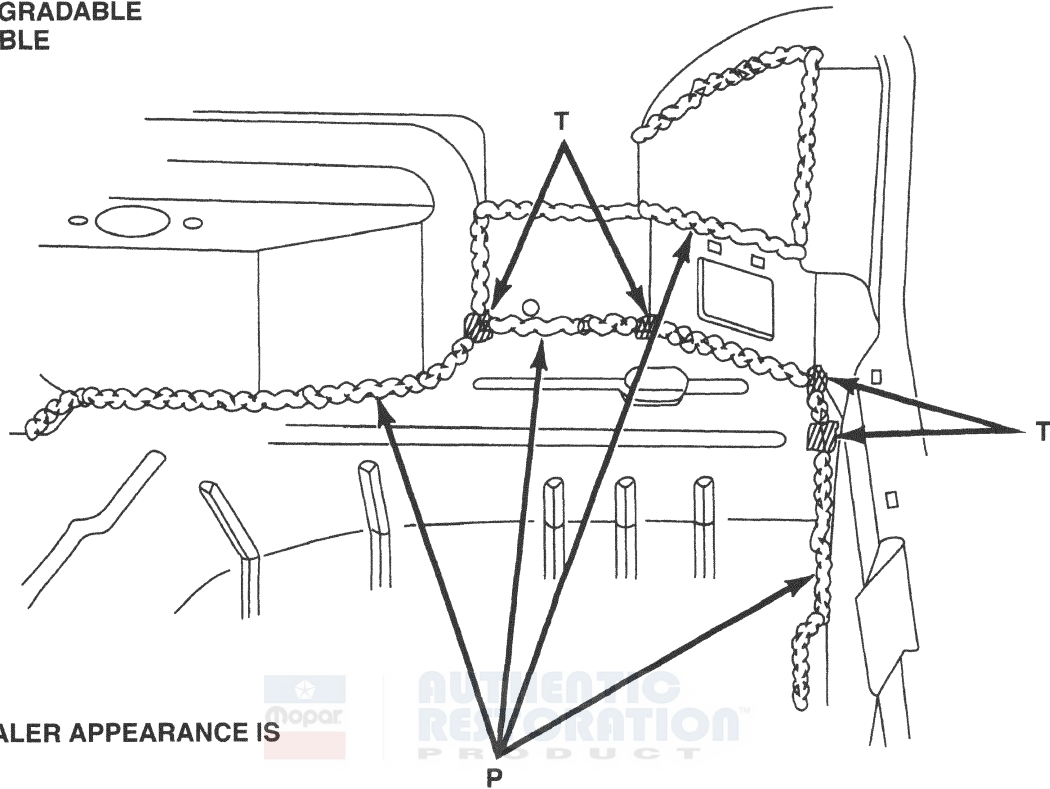


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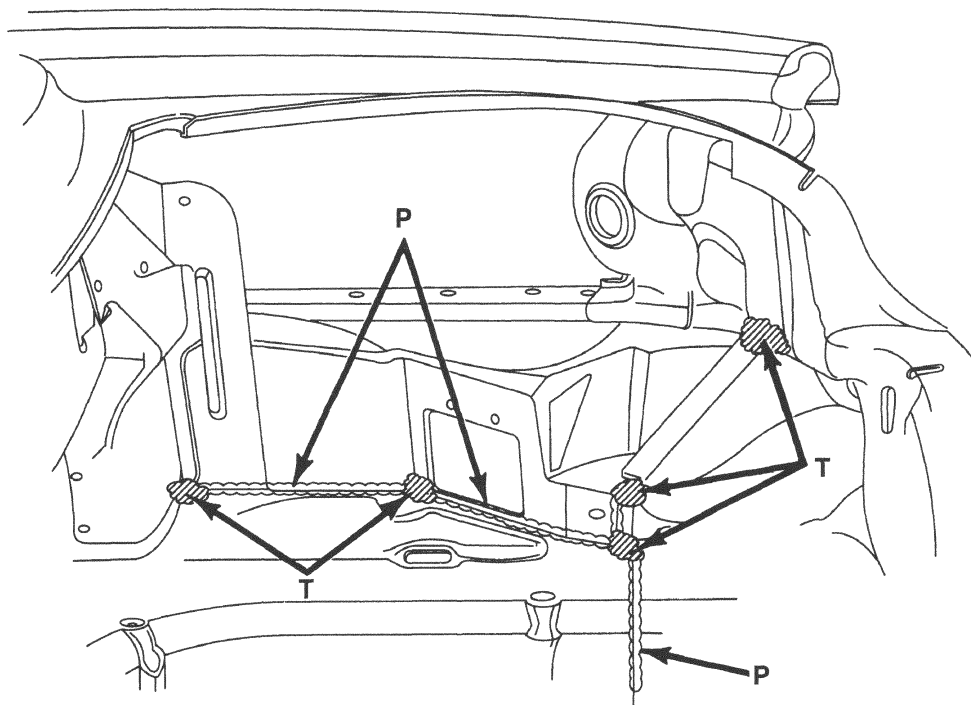


**SPECIFICATIONS (Continued)****TRUNK FLOOR AREA**

T = THUMBGRADABLE  
P = PUMPABLE

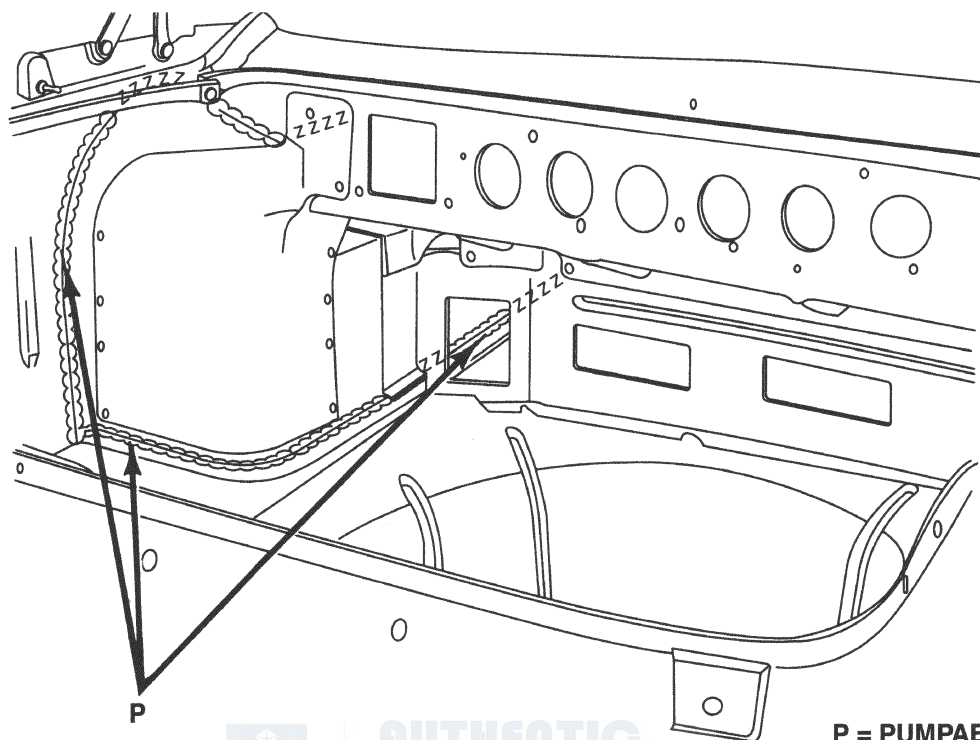


NOTE: SEALER APPEARANCE IS CRITICAL



**SPECIFICATIONS (Continued)**

**TRUNK FLOOR AREA**



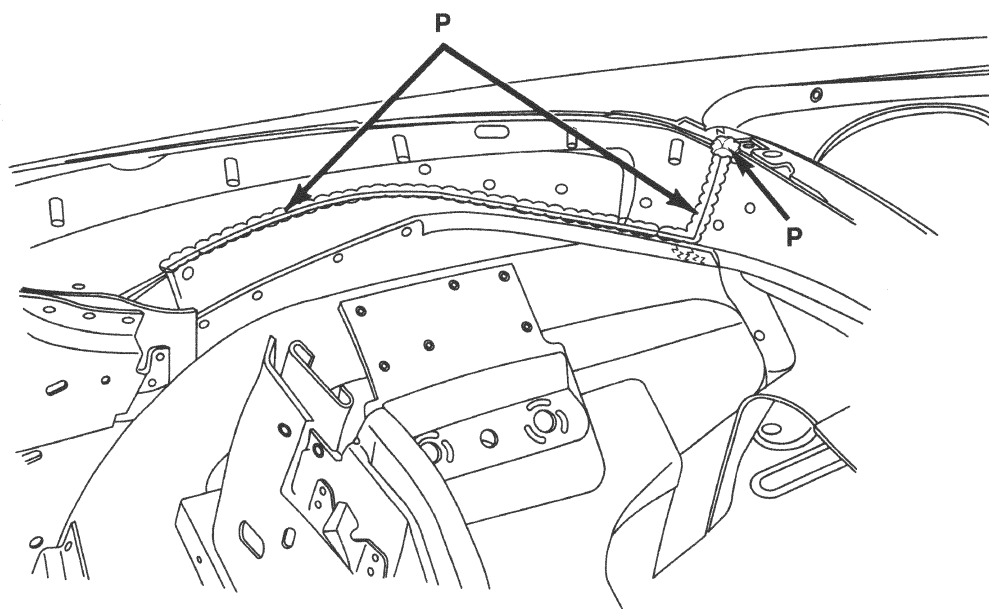
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**P = PUMPABLE**

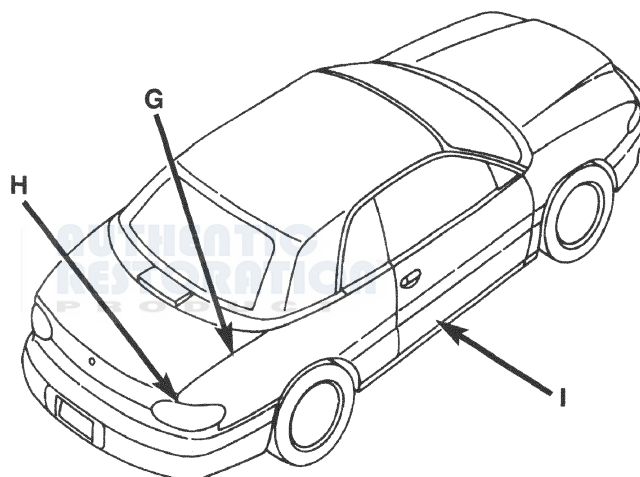
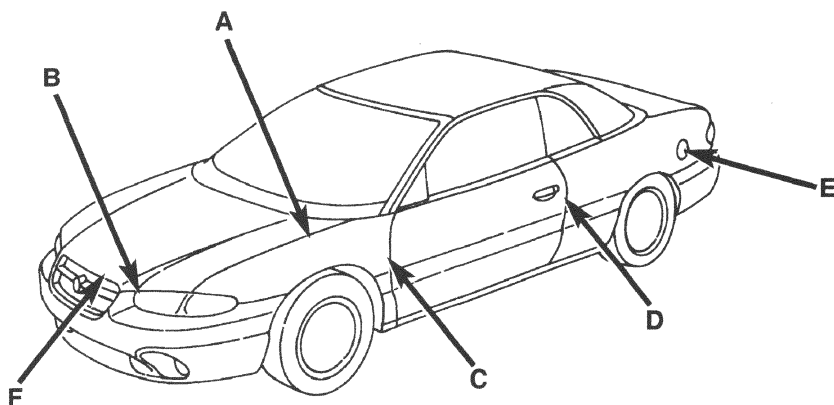
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**TOP WELL AREA**

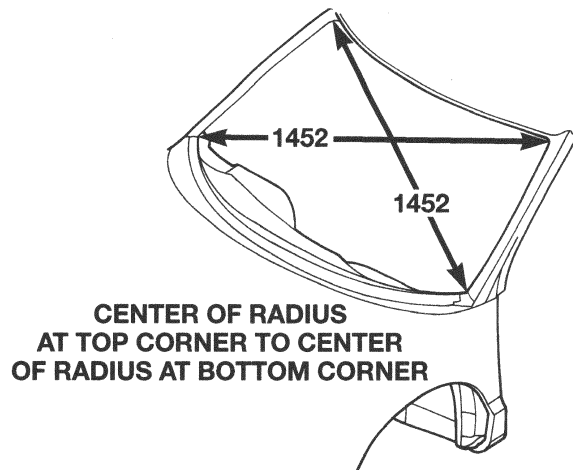
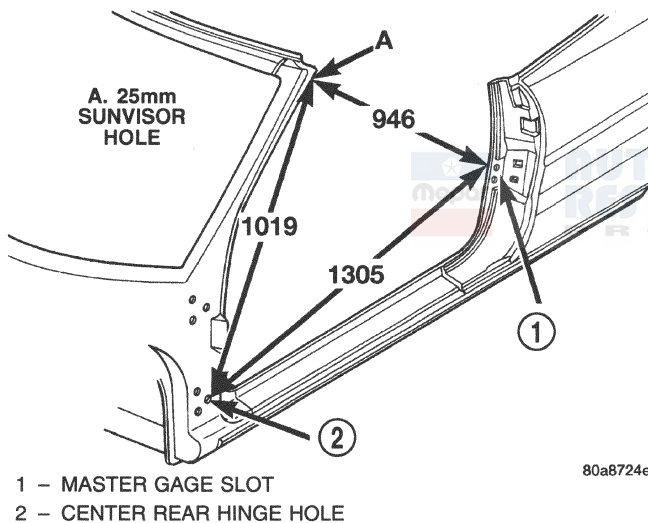
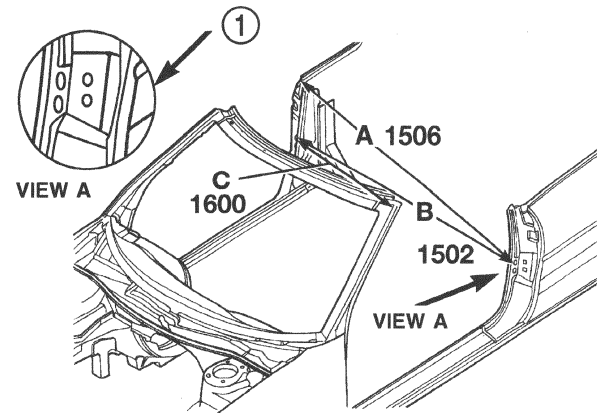
**P = PUMPABLE**



80b62bd6

**SPECIFICATIONS (Continued)****BODY GAP AND FLUSH MEASUREMENTS****BODY GAP AND FLUSH**

	LOCATION	GAP	FLUSH
<b>A</b>	Hood to Fender	$4.0 \pm 1.0 // 1.0$	UFLSH $0.75 \pm 0.5 // 1/0$
<b>B</b>	Hood to Fender Fore and Aft	N/A	FLSH $\pm 1.0$
<b>C</b>	Front Door to fender	$4.0 \pm 1.0 // 1.0$	FLSH $\pm 1.0$
<b>D</b>	Front Door to Quarter Panel	$3.0 + 1.5 / =0.5 // 1.0$	FLSH $\pm 1.0$
<b>E</b>	Fuel Filler Door to Quarter	$3.0 \pm 0.75 // 1.0$	UFLSH 0.62 @ TOP
<b>F</b>	Fascia to Hood	$8.0 \pm 2.0 // 1.2$	OFLSH $\pm 2.0$
<b>G</b>	Decklid to Quarter Panel	$4.0 \pm 1.0 // 1.0$	$0.75 + 0.5 / -1.0 // 1.0$
<b>H</b>	Taillamp to Applique and Decklid	$8.0 \pm 1.0$	OFLSH BY DESIGN
<b>I</b>	Front Door to Sill	$6.0 \pm 2.0 // 1.5$	$6.0 + 0.0 / -1.0$

**SPECIFICATIONS (Continued)****BODY OPENING DIMENSION****WINDSHIELD OPENING****DOOR OPENING****CROSS - BODY DIMENSIONS**

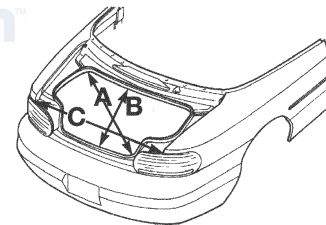
A. DOOR OPENING PLP TO

1 - CENTER OF MASTER GAGE SLOT

80a8724f

**TRUNK OPENING**

- A. 998  
B. 569  
C. 1193



- A. CENTER OF DECK OPENING FRONT CORNER RADIUS TO REAR TAIL PANEL DECK OPENING RADIUS.
- B. FRONT DECK OPENING WEATHERSTRIP FLANGE TO DECK OPENING TAIL PANEL WEATHERSTRIP FLANGE.
- C. REAR OF QUARTER PANEL AT TAIL-LIGHT OPENING TO OPPOSITE POINT.

80a8724a



**SPECIFICATIONS (Continued)****TORQUE SPECIFICATIONS****BODY COMPONENTS**

DESCRIPTION	TORQUE
Front seat track to floor pan bolts . . . . .	61 N·m (45 ft. lbs.)
Front seat inboard pivot bolt . . . . .	40 N·m (30 ft. lbs.)
Front seat frame recliner housing to seat frame. . . . .	34 N·m (300 in. lbs.)
Front seat recliner to seat cushion frame . . .	12 N·m (9 ft. lbs.)
Front seat recliner lead screw to seat frame . . . . .	5.3 N·m (33.3 ft. lbs.)
Front seat track to cushion frame bolt . . . . .	12 N·m (9 ft. lbs.)
Front seat back to frame . . . . .	45.3 N·m (33.3 ft. lbs.)
Front seat back recliner to seat back . . . . .	12 N·m (9 ft. lbs.)
Front seat belt buckle anchor nut . . . . .	45 N·m (33 ft. lbs.)
Front seat belt retractor bolt . . . . .	16.2 N·m (12 ft. lbs.)

DESCRIPTION	TORQUE
Front seat belt buckle anchor bolt . . . . .	40 N·m (29 ft. lbs.)
Front door hinge to hinge pillar bolt . . . . .	28 N·m (21 ft. lbs.)
Front door hinge to door nuts and bolt . . . . .	28 N·m (21 ft. lbs.)
Front door latch striker . . . . .	28 N·m (20 ft. lbs.)
Front seat rear outboard seat track to floor pan bolts . . . . .	28 N·m (20 ft. lbs.)
Decklid latch striker . . . . .	22 N·m (16 ft. lbs.)
Lower seat belt anchor and seat belt buckle . . . . .	45.3 N·m (33.3 ft. lbs.)
Rear inner seat belt assembly . . . . .	40 N·m (350 in. lbs.)
Seat belt fasteners is . . . . .	40 N·m (350 in. lbs.)
Rear door glass to regulator bolt . . . . .	11 N·m (105 in. lbs.)
Rear door hinge to B-pillar bolt . . . . .	28 N·m (20 ft. lbs.)
Rear door hinge to door bolt . . . . .	28 N·m (20 ft. lbs.)
Rear door latch striker . . . . .	28 N·m (20 ft. lbs.)



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# HEATING AND AIR CONDITIONING

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## DESCRIPTION AND OPERATION

### A/C PRESSURE TRANSDUCER

#### DESCRIPTION

The a/c pressure transducer is located on the discharge line near the compressor, and functions as the refrigerant system pressure sensor. This switch prevents compressor operation when the discharge line pressure approaches extreme levels.

The a/c pressure transducer is a factory-calibrated unit. The switch cannot be adjusted or repaired, and if faulty or damaged, it must be replaced.

#### OPERATION

When the discharge line pressure rises above 2971 kPa (431 psi) the switch contacts open and interrupt the A/C clutch relay signal from the PCM. The switch also opens when the pressure drops below 206 kPa (30 psi). The PCM responds by de-energizing the compressor clutch relay, which will disengage the compressor clutch.

### A/C REFRIGERANT LINES

#### DESCRIPTION

The air conditioning lines used on this vehicle are made from reinforced rubber with a nylon liner on the inner walls. The ends of the A/C lines are made with light weight aluminum fittings or quick connects.

The A/C lines use special connectors called quick connects. There are four quick connects in the system. Two are located at the condenser and the other two are located at the expansion valve. Each quick connector has a clip installed on it.

All quick connects use two O-rings to seal the connection. The O-rings are made from a special type of rubber that is not affected by R-134a refrigerant. O-ring replacement is required whenever lines are removed and installed. Use only O-rings specified for this vehicle. Failure to use the correct type of O-ring will cause the connection to leak within a short period of time.

#### OPERATION

**CAUTION:** Never attempt to remove a clip or disconnect a quick connect without reclaiming all refrigerant from the air conditioning system. The system must be empty.

When it is necessary to open the refrigeration system, have everything needed to service the system ready. The system should not be left open any longer than necessary. Cap or plug all lines and fittings as

soon as they are opened. This will prevent the entrance of dirt and moisture into the system. All new lines and components should be capped or sealed until they are ready to be used.

**WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.**

**R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.**

### BLOWER MOTOR RESISTOR

#### DESCRIPTION

The blower motor resistor is mounted to the lower right side of the heater-A/C housing in the passenger compartment, where it can be accessed for service. See Blower Motor Resistor in the Removal and Installation section of this group for more information.

The blower motor resistor has multiple resistor wires, each of which will change the resistance in the blower motor ground path to change the blower motor speed. The blower motor switch directs the ground path through the correct resistor wire to obtain the selected blower motor speed.

The blower motor resistor cannot be repaired and, if faulty or damaged, it must be replaced.

#### OPERATION

With the blower motor switch in the lowest speed position the ground path for the motor is applied through all of the resistor wires. Each higher speed selected with the blower motor switch applies the blower motor ground path through fewer of the resistor wires, increasing the blower motor speed. When the blower motor switch is in the highest speed position, the blower motor resistor is bypassed and the blower motor receives a direct path to ground.

### COMPRESSOR

#### DESCRIPTION

The TRS90 is a fixed displacement type compressor (Fig. 1). This compressor uses an integral thermal



## DESCRIPTION AND OPERATION (Continued)

limiter switch to protect it from overheating. The system uses polyalkylene glycol synthetic wax-free refrigerant oil SP-15 PAG.

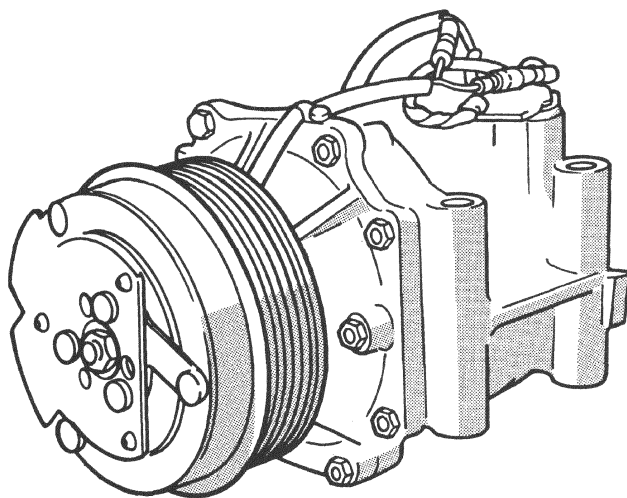
**CAUTION:** Cleanliness is extremely important. Clean the surfaces around the suction and discharge ports of the compressor before opening the system. If compressor is removed from vehicle, apply tape to the opened ports to prevent any contamination.

### OPERATION

The compressor is driven by the engine through an electric clutch, drive pulley and belt arrangement. The compressor is lubricated by refrigerant oil that is circulated throughout the refrigerant system with the refrigerant.

The compressor draws in low-pressure refrigerant vapor from the evaporator through its suction port. It then compresses the refrigerant into a high-pressure, high-temperature refrigerant vapor, which is then pumped to the condenser through the compressor discharge port.

The compressor cannot be repaired. If faulty or damaged, the entire compressor must be replaced. The compressor clutch, pulley, clutch coil, and thermal limiter switch are available for service.



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*Fig. 1 TRS90 Compressor*

## COMPRESSOR CLUTCH, PULLEY, AND COIL

### DESCRIPTION

The compressor clutch components provide a way to drive the compressor. The compressor clutch assembly consists of a stationary electromagnetic coil, a hub bearing and pulley assembly, and a clutch plate. The electromagnetic coil unit and the hub

bearing and pulley assembly are each retained on the nose of the compressor front housing with snap rings. The clutch plate is mounted on the compressor shaft and secured with a nut. The compressor clutch and coil assembly are the only serviced parts on the compressor.

### OPERATION

These components provide the means to engage and disengage the compressor from the engine serpentine accessory drive belt. When the clutch coil is energized, it magnetically draws the clutch into contact with the pulley and drives the compressor shaft. When the coil is not energized, the pulley freewheels on the clutch hub bearing, which is part of the pulley. The compressor clutch and coil are the only serviced parts on the compressor.

The compressor clutch is controlled by several components: the heater-A/C mode control switch, the a/c pressure transducer, the evaporator probe, the thermal limiter switch, the compressor clutch relay, and the Powertrain Control Module (PCM).

## CONDENSER

### DESCRIPTION

The condenser is a heat exchanger that allows the high-pressure refrigerant gas being discharged by the compressor to give up its heat to the air passing over the condenser fins.

### OPERATION

The condenser is located in the air flow in front of the engine cooling radiator. When the refrigerant gas gives up its heat, it condenses. When the refrigerant leaves the condenser, it has become a high-pressure liquid refrigerant. The volume of air flowing over the condenser fins is critical to the proper cooling performance of the air conditioning system. Therefore, it is important that there are no objects placed in front of the radiator grille openings in the front of the vehicle or foreign material on the condenser fins that might obstruct proper air flow. Also, any factory-installed air seals or shrouds must be properly reinstalled following radiator or condenser service.

The condenser cannot be repaired and, if faulty or damaged, it must be replaced.

## ENGINE COOLING SYSTEM REQUIREMENTS

### DESCRIPTION

To maintain ample temperature levels from the heating-A/C system, the cooling system must be in proper working order.



**DESCRIPTION AND OPERATION (Continued)****OPERATION**

The use of a bug screen is not recommended. Any obstructions forward of the condenser can reduce the effectiveness of the air conditioning system. Refer to Group 0, Lubrication and Maintenance or Group 7, Cooling System of this manual.

**EVAPORATOR COIL****DESCRIPTION**

The evaporator coil is located in the heater-A/C housing, on the passenger side of the vehicle. The evaporator coil is positioned in the heater-A/C housing so that all air that enters the housing must pass over the fins of the evaporator before it is distributed through the system ducts and outlets. However, air passing over the evaporator coil fins will only be conditioned when the compressor is engaged and circulating refrigerant through the evaporator coil tubes.

The evaporator coil cannot be repaired and, if faulty or damaged, it must be replaced.

**OPERATION**

Refrigerant enters the evaporator from the expansion valve as a low-temperature, low-pressure mixture of liquid and gas. As air flows over the fins of the evaporator, the humidity in the air condenses on the fins, and the heat from the air is absorbed by the refrigerant. Heat absorption causes the refrigerant to boil and vaporize. The refrigerant becomes a low-pressure gas before it leaves the evaporator.

**EVAPORATOR PROBE****DESCRIPTION**

The evaporator probe is a 2 wire temperature sensing element located at the coldest point on the face of the evaporator. The switch is attached to the evaporator coil with the sensing probe inserted into the coil fins. The evaporator temperature probe prevents condensate water on the evaporator coil from freezing and obstructing A/C system air flow.

**OPERATION**

The probe is used to switch the clutch OFF before evaporator freeze-up occurs. Output from the probe is sampled by the Body Control Module. The clutch is switched OFF when the probe temperature reaches 1.1°C (34°F). It is allowed to switch ON when the probe temperature reaches 2.2°C (36°F).

**EXPANSION VALVE****DESCRIPTION**

The "H" valve-type thermal expansion valve (TXV) is located at the front of the heater-A/C housing

between the liquid and suction lines and the evaporator coil.

The expansion valve is a factory calibrated unit and cannot be adjusted or repaired. If faulty or damaged, the expansion valve must be replaced.

**OPERATION**

High-pressure, high temperature liquid refrigerant from the liquid line passes through the expansion valve orifice, converting it into a low-pressure, low-temperature mixture of liquid and gas before it enters the evaporator coil. A temperature sensor in the expansion valve control head monitors the temperature of the refrigerant leaving the evaporator coil through the suction line, and adjusts the orifice size at the liquid line to let the proper amount of refrigerant into the evaporator coil to meet the vehicle cooling requirements. Controlling the refrigerant flow through the evaporator ensures that none of the refrigerant leaving the evaporator is still in a liquid state, which could damage the compressor.

**FILTER-DRIER****DESCRIPTION**

The filter-drier is mounted on the right side of the engine compartment in front of the heater-A/C housing. It is located in the liquid line between the condenser outlet and the evaporator inlet.

**OPERATION**

High-pressure liquid refrigerant from the condenser flows into the filter-drier. The filter-drier performs a filtering action to prevent foreign material in the refrigerant from contaminating the expansion valve. A desiccant bag is mounted inside the filter-drier canister to absorb any moisture which may have entered and become trapped within the refrigerant system. In addition, during periods of high demand air conditioner operation, the filter-drier acts as a reservoir to store surplus refrigerant.

The filter-drier cannot be repaired. If the filter-drier is faulty or damaged, if the refrigerant system has been contaminated, or if the system has been left open to the atmosphere for an indeterminable period, it must be replaced.

**HANDLING TUBING AND FITTINGS****DESCRIPTION**

Kinks in the refrigerant tubing or sharp bends in the refrigerant hose lines will greatly reduce the capacity of the entire system.

## DESCRIPTION AND OPERATION (Continued)

**CAUTION:** The system must be completely empty before opening any fitting or connection in the refrigeration system. Open fittings with caution even after the system has been emptied. If any pressure is noticed as a fitting is loosened, retighten fitting and evacuate the system again.

A good rule for the flexible hose lines is to keep the radius of all bends at least 10 times the diameter of the hose. Sharper bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 3 inches (80 mm) from the exhaust manifold. Inspect all flexible hose lines to make sure they are in good condition and properly routed.

The use of correct wrenches when making connections is very important. Improper wrenches or improper use of wrenches can damage the fittings.

The internal parts of the A/C system will remain stable as long as moisture-free refrigerant and refrigerant oil is used. Abnormal amounts of dirt, moisture or air can upset the chemical stability. This may cause operational troubles or even serious damage if present in more than very small quantities.

When opening a refrigeration system, have everything you will need to repair the system ready. This will minimize the amount of time the system must be opened. Cap or plug all lines and fittings as soon as they are opened. This will help prevent the entrance of dirt and moisture. All new lines and components should be capped or sealed until they are ready to be used.

All tools, including the refrigerant dispensing manifold, the manifold gauge set, and test hoses should be kept clean and dry.

## OPERATION

High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all connections are pressure tight. Dirt and moisture can enter the system when it is opened for repair or replacement of lines or components. The refrigerant oil will absorb moisture readily out of the air. This moisture will convert into acids within a closed system.

## HIGH PRESSURE RELIEF VALVE

### DESCRIPTION

The high pressure relief valve is located on the rear surface of the compressor housing. This mechanical valve is designed to vent refrigerant from the system to protect against damage to the compressor and other system components, caused by condenser air flow restriction or an overcharge of refrigerant.

The high pressure relief valve vents the system when a discharge pressure of 3445 to 4135 kPa (500 to 600 psi) or above is reached. The valve closes with a minimum discharge pressure of 2756 kPa (400 psi) is reached.

The high pressure relief valve is only serviced as part of the compressor assembly, and must not be removed or otherwise disturbed.

## OPERATION

The high pressure relief valve vents only enough refrigerant to reduce the system pressure, and then re-seats itself. The majority of the refrigerant is conserved in the system. If the valve vents refrigerant, it does not mean the valve is faulty.

On new compressor assemblies, a mylar disc is applied to the venting port of the valve. The disc is primarily intended for protection of the valve during the painting operation. A missing or damaged disc does not indicate failure. If the mylar disc has loosened or come off, apply a drop or two of refrigerant oil into the valve mechanism through the venting holes. This will prevent salt, dirt, or moisture from affecting the operation of the valve.

## REFRIGERANT

### DESCRIPTION

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear, and colorless liquefied gas.

Even though R-134a does not contain chlorine, it must be reclaimed and recycled just like CFC-type refrigerants. This is because R-134a is a greenhouse gas and can contribute to global warming.

## OPERATION

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 added to an R-134a refrigerant system will cause compressor failure, refrigerant oil sludge or poor air conditioning system performance. In addition, the PolyAlkylene Glycol (PAG) synthetic refrigerant oils used in an R-134a refrigerant system are not compatible with the mineral-based refrigerant oils used in an R-12 refrigerant system.

R-134a refrigerant system service ports, service tool couplers and refrigerant dispensing bottles have all been designed with unique fittings to ensure that an R-134a system is not accidentally contaminated with the wrong refrigerant (R-12). There are also labels posted in the engine compartment of the vehicle and on the compressor identifying to service tech-



**DESCRIPTION AND OPERATION (Continued)**

nicians that the air conditioning system is equipped with R-134a.

**REFRIGERANT SYSTEM SERVICE PORT****DESCRIPTION**

The high pressure service port is located on the discharge line between the compressor and the condenser over the cooling fans, near the front of the engine compartment. The low pressure service port is located on the suction line, near the right strut tower.

Each of the service ports has a threaded plastic protective cap installed over it from the factory. After servicing the refrigerant system, always reinstall both of the service port caps.

**OPERATION**

The two refrigerant system service ports are used to charge, recover/recycle, evacuate, and test the air conditioning refrigerant system. Unique service port coupler sizes are used on the R-134a system, to ensure that the refrigerant system is not accidentally contaminated by the use of the wrong refrigerant (R-12), or refrigerant system service equipment.

**SYSTEM AIRFLOW****DESCRIPTION**

The system draws outside air through the cowl opening at the base of the windshield. It flows into the plenum chamber above the Heater A/C unit housing and passes through the evaporator. At this point airflow can be directed either through or around the heater core. This is done by adjusting the blend-air door with the TEMP control on the control head. After the air passes the blend air door, the air flow is then directed from the PANEL, BI-LEVEL (panel and floor), and FLOOR-DEFROST outlets. Air flow velocity can be adjusted with the blower speed selector switch on the control head.

**OPERATION**

Ambient air intake can be shut off by closing the recirculating air door. This will recirculate the air that is already inside the vehicle. This is done by rotating the RECIRC. knob on the control head. Rotating the MODE control knob to the Defrost/Floor or Defrost setting on the control head will engage the compressor. This will send refrigerant through the evaporator, and remove heat and humidity from the air before it goes through the heater core. The compressor can also be engaged by depressing the A/C button on the control head.

**THERMAL LIMITER SWITCH****DESCRIPTION**

The thermal limiter switch is used to measure the compressor surface temperature. If the compressor surface temperature is excessive, the switch will cut the battery feed voltage to the compressor clutch coil. The switch will reset itself, once the compressor surface temperature returns to normal. The switch itself is not adjustable or serviceable. If faulty the compressor must be replaced.

**OPERATION**

The thermal limiter switch will interrupt the battery feed to the compressor clutch coil at a temperature of about 122 to 128° C (250 to 260° F). The switch will reset and restore the clutch coil operation at a temperature of about 104 to 116° C (220 to 240° F).

**DIAGNOSIS AND TESTING****A/C PERFORMANCE TEST**

The air conditioning system is designed to remove heat and humidity from the air entering the passenger compartment. The evaporator, located in the heater A/C unit, is cooled to temperatures near the freezing point. As warm damp air passes over the fins in the evaporator, moisture in the air condenses to water, dehumidifying the air. Condensation on the evaporator fins reduces the evaporator's ability to absorb heat. During periods of high heat and humidity, an air conditioning system will be less effective. With the control module set to RECIRC, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, A/C performance levels rise.

**PERFORMANCE TEST PROCEDURE**

Review Safety Precautions and Warnings in this group before proceeding with this procedure. Air temperature in test room and on vehicle must be 21° C (70°F) minimum for this test.

**NOTE:** When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection.

- (1) Connect a tachometer and manifold gauge set. Attach a thermocouple to the evaporator inlet line.
- (2) Set control to A/C, RECIRC, and PANEL, temperature lever on full cool and blower on high.
- (3) Start engine and hold at 1000 rpm with A/C clutch engaged.

## DIAGNOSIS AND TESTING (Continued)

(4) Engine should be warmed up with doors and windows closed.

(5) Insert a thermometer or place a thermocouple in the left center A/C outlet and operate the engine for five minutes. The A/C clutch may cycle depending on ambient conditions.

(6) With the A/C clutch engaged, compare the discharge air temperature to the evaporator inlet line temperature. The evaporator inlet line temperature should be no more than 5.5°C (10°F) cooler than the discharge air temperature.

(7) If the discharge air temperature fails to meet the specifications, refer to the System Charge Level.

## COMPRESSOR CLUTCH COIL

(1) Verify battery state of charge.

(2) Connect an ammeter (0-10 ampere scale) in series with the clutch coil terminal. Use a volt meter (0-20 volt scale) with clip leads measuring voltage across the battery and A/C clutch.

(3) With A/C control in A/C mode and blower at low speed, start the engine and run at normal idle.

(4) The A/C clutch should engage immediately and the clutch voltage should be within 2 volts of the battery voltage. If the A/C clutch does not engage, test the fusible link.

(5) The A/C clutch coil is acceptable if the current draw is 2.0 to 4.15 amperes at 11.5 to 12.5 volts at clutch coil. This is with the work area temperature at 21°C (70°F). If voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until voltage reads below 12.5 volts.

(6) If coil current reads zero, the coil is open and should be replaced. If the ammeter reading is 5 amperes or more, the coil is shorted and should be replaced. If the coil voltage is not within two volts of the battery voltage, test clutch coil feed circuit for excessive voltage drop.

## COMPRESSOR NOISE TEST

When investigating an air conditioning related noise, you must first know the conditions when the noise occurs. These conditions are: weather, vehicle speed, in gear or neutral, engine temperature, or any other special condition.

Noises that develop during air conditioning operation can often be misleading. For example: what sounds like a failed front engine bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose clutch assembly. Improper drive belt tension can cause a misleading noise when compressor is engaged. The noise may not occur when compressor is disengaged.

Drive belt(s) are speed sensitive. At different engine speeds and depending upon belt tension,

belt(s) can develop noises that are mistaken for a compressor noise.

(1) Select a quiet area for testing. Duplicate conditions as much as possible. Switch compressor on and off several times to clearly identify compressor noise. Listen to compressor clutch while engaged and disengaged.

(2) To duplicate high-ambient condition (high-head pressure), restrict air flow through condenser. Install manifold gauge set to make sure discharge pressure doesn't exceed 2070 kPa (300 psi).

(3) Tighten ALL compressor mounting bolts, clutch mounting bolt, clutch coil mounting screws

(4) Check refrigerant hoses for rubbing or interference which can cause unusual noises.

(5) Check refrigerant charge (refer to Charging the System).

(6) Check compressor noise as in Step 1.

(7) If noise still exists, loosen compressor mounting bolts and torque. Repeat Step 1.

(8) If noise continues, replace compressor and repeat Step 1.

## CONTROL MODULE

The control switch and timer circuit may be tested in the vehicle with or without scan tool (DRB).

### TESTING WITH SCAN TOOL

If using the scan tool, refer to the proper Body Diagnostic Procedures Manual.

### TESTING WITHOUT SCAN TOOL

(1) Remove the control switch from console and disconnect control switch (Fig. 2).

(2) Using a ohmmeter, check leads between Pins 5 and 8 of the 8-Way connector. Turn the control module to each position shown on Control Module Test table. The resistance reading should be within the specifications shown. If not OK, replace the control module. If OK, check:

- Blown fuse
- Cut wire
- Poor ground
- Poor connection
- Defective BCM
- Bulkhead connector inoperative

Refer to Group 8W, Wiring Diagrams.

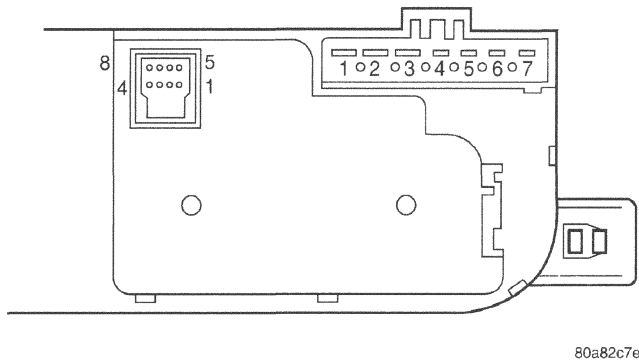
## HEATER PERFORMANCE TEST

### PRE-DIAGNOSTIC PREPARATIONS

Review Safety Precautions and Warnings in this group before performing the following procedures.

Check the coolant level, drive belt tension, vacuum line connections, radiator air flow and fan operation. Start engine and allow to warm up to normal temperature.



**DIAGNOSIS AND TESTING (Continued)**

**Fig. 2 HVAC Control Module Connectors**  
**CONTROL MODULE TEST**

SWITCH POSITION	OHM RANGE
Panel	828 to 856 ohms
Bi-Level	1.279 to 1.315 K ohms
Floor	2.302 to 2.358 K ohms
Mix	5.202 to 5.318 K ohms
Defrost	99.5 to 101.5 K ohms

**WARNING: DO NOT REMOVE RADIATOR CAP WHEN ENGINE IS HOT, PERSONAL INJURY CAN RESULT.**

If vehicle has been run recently, wait 15 minutes before removing cap. Place a rag over the cap and turn it to the first safety stop. Allow pressure to escape through the overflow tube. When the system stabilizes, remove the cap completely.

**MAXIMUM HEATER OUTPUT: TEST AND ACTION**

Engine coolant is provided to the heater system by two 16 mm (5/8 inch inside diameter) heater hoses. With engine idling at normal running temperature, set the control to maximum heat, floor, and high blower setting. Using a test thermometer, check the air temperature coming from the floor outlets, refer to Temperature Reference Table.

**TEMPERATURE REFERENCE TABLE**

Ambient Temp.		Minimum Floor Outlet Temp.	
Celsius	Fahrenheit	Celsius	Fahrenheit
15.5°	60°	62.2°	144°
21.1°	70°	63.8°	147°
26.6°	80°	65.5°	150°
32.2°	90°	67.2°	153°

If the floor outlet air temperature is insufficient, refer to Group 7, Engine Cooling for specifications. Both heater hoses should be HOT to the touch (coolant return hose should be slightly cooler than the supply hose). If coolant return hose is much cooler than the supply hose, locate and repair engine coolant flow obstruction in heater system.

**POSSIBLE LOCATIONS OR CAUSE OF OBSTRUCTED COOLANT FLOW**

- (1) Pinched or kinked heater hoses.
- (2) Improper heater hose routing.
- (3) Plugged heater hoses or supply and return ports at cooling system connections, refer to Group 7, Cooling System.
- (4) Plugged heater core.
- (5) Air locked heater core.
- (6) If coolant flow is verified and outlet temperature is insufficient, a mechanical problem may exist.

**POSSIBLE LOCATION OR CAUSE OF INSUFFICIENT HEAT**

- (1) Obstructed cowl air intake.
- (2) Obstructed heater system outlets.
- (3) Blend-air door not functioning properly.

**TEMPERATURE CONTROL**

If temperature cannot be adjusted with the TEMP lever on the control panel, the following could require service:

- (1) Blend-air door binding.
- (2) Improper engine coolant temperature.
- (3) Faulty Instrument Panel Control.

**SYSTEM OIL LEVEL**

It is important to have the correct amount of lubricant in the A/C system to ensure proper lubrication of the compressor. Too little lubricant will result in damage to the compressor. Too much lubricant will reduce the cooling capacity of the system and consequently result in higher discharge air temperatures.

The lubricant used in the compressor is polyalkylene glycol PAG lubricant. Only PAG refrigerant lubricant approved for use with R-134a should be used to service the system. Do not use any other lubricant. The lubricant container should be kept tightly capped until it is ready for use. Refrigerant lubricant will quickly absorb any moisture it comes in contact with.

It is not necessary to check or add lubricant unless it has been lost. Lubricant loss at the leak point will be evident by the presence of a wet, shiny surface around the leak.

## DIAGNOSIS AND TESTING (Continued)

### REFRIGERANT OIL LEVEL CHECK

When an air conditioning system is first assembled, all components (except the compressor) are refrigerant oil free. After the system has been charged with (R-134a) refrigerant and operated, the oil in the compressor is dispersed through the lines and components. The evaporator, condenser, and receiver/drier will retain a significant amount of oil. Refer to the A/C Component Refrigerant Oil Capacities table. When a component is replaced, the specified amount of refrigerant oil must be added. When the compressor is replaced, the amount of oil that is retained in the rest of the system must be drained from the replacement compressor. When a line or component has ruptured and oil has escaped, the compressor should be removed and drained. The receiver/drier must be replaced along with the ruptured part. The oil capacity of the system, minus the amount of oil still in the remaining components, can be measured and poured into the suction port of the compressor.

Example: On an A/C system the evaporator retains 60 ml. (2 oz.). The condenser retains 30 ml. (1 oz.) of oil, and system capacity may be 150 ml. (5.00 oz.) of oil. 150 ml. minus 90 ml. equals 60 ml. (2.00 oz.).

#### A/C COMPONENT REFRIGERANT OIL CAPACITIES

COMPONENT NAME	ml.	oz.
Total Air Conditioning System	150 ml.	5.00 oz.
Condenser	30 ml.	1.00 oz.
Evaporator	59 ml.	2.00 oz.
Filter/Drier	30 ml.	1.00 oz.
Line Blown	44 ml.	1.50 oz.

**CAUTION:** The refrigerant oil used in a R-134a A/C system is unique. Use only oils which were designed to work with R-134a refrigerant. The oil designated for this vehicle is SP-15 PAG (polyalkylene glycol).

### VERIFY REFRIGERANT LUBRICANT LEVEL

- (1) Discharge refrigerant system using a recycling/reclaiming equipment if a charge is present.
- (2) Disconnect refrigerant lines from A/C compressor. Cap the open lines to prevent moisture from entering system.
- (3) Remove compressor from vehicle.
- (4) From suction and discharge ports on top of compressor, drain lubricant from compressor.
- (5) Add system capacity minus the capacity of components that have not been replaced. Refer to the A/C Component Refrigerant Oil Capacities chart above. Add lubricant through the suction and dis-

charge ports on compressor. This is not to exceed 150 ml. (5.00 oz.) in total.

(6) Install compressor and connect refrigerant lines. Then evacuate and charge refrigerant system.

(7) Most reclaim/recycling equipment will measure the lubricant being removed. This is the amount of lubricant to be added back to the system. If a new compressor is being installed, drain lubricant from old compressor, measure the amount drained and discard old lubricant. Drain the lubricant from the new compressor into a clean container. Return the amount of lubricant measured from the old compressor, plus the amount reclaimed from the system back into the new compressor.

### THERMAL LIMITER SWITCH

- (1) Unplug Thermal Limiter wiring connector.
- (2) With an ohmmeter check for continuity between the two terminals. If no continuity is present, replace the compressor.
- (3) The Thermal Limiter is calibrated to open and close at:
  - Open circuit (no continuity) at 122 to 128°C (252 to 262°F)
  - Close circuit (continuity) at 106 to 116°C (225 to 235°F)

**There is no serviceability of the thermal limiter switch. If the thermal limiter switch fails, the compressor must be replaced. To replace the compressor, refer to Compressor Removal and Installation in this section.**

## SERVICE PROCEDURES

### EVACUATING REFRIGERANT SYSTEM

**NOTE:** Special effort must be used to prevent moisture from entering the A/C system oil. Moisture in the oil is very difficult to remove and will cause a reliability problem with the compressor.

If a compressor designed to use R-134a refrigerant is left open to the atmosphere for an extended period of time. It is recommended that the refrigerant oil be drained and replaced with new oil or a new compressor be used. This will eliminate the possibility of contaminating the refrigerant system.

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be filled. Moisture and air mixed with the refrigerant will raise the compressor head pressure above acceptable operating levels. This will reduce the performance of the air conditioner and damage the compressor. Moisture will boil at near room temperature when exposed to vacuum. To evacuate the refrigerant system:



**SERVICE PROCEDURES (Continued)**

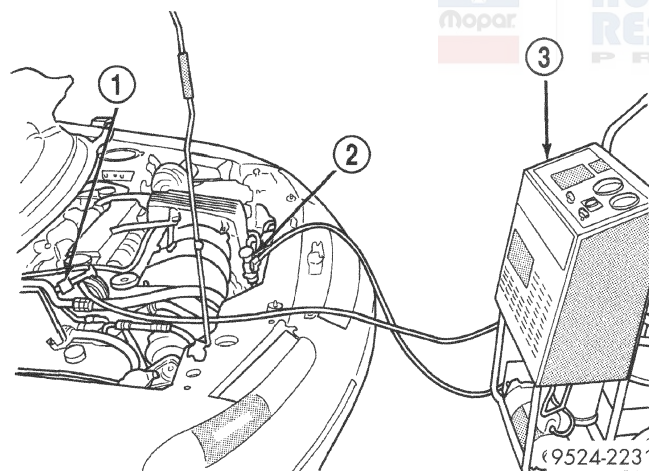
**NOTE:** When connecting the service equipment coupling to the line fitting, verify that the valve of the coupling is fully closed. This will reduce the amount of effort required to make the connection. If connection is still difficult to make refer to TSB #24-02-93.

(1) Connect a suitable charging station, refrigerant recovery machine, and a manifold gauge set with vacuum pump (Fig. 3).

(2) Open suction and discharge valves and start vacuum pump. The vacuum pump should run a minimum of 45 minutes prior to charge, to eliminate all moisture in system. When suction gauge reads -88 kPa (-26 in. Hg) vacuum or greater for 45 minutes, close all valves and turn off vacuum pump. If the system fails to reach specified vacuum, the refrigerant system likely has a leak that must be corrected. If the refrigerant system maintains specified vacuum for at least 30 minutes, start the vacuum pump, open the suction and discharge valves. Then allow the system to evacuate an additional 10 minutes.

(3) Close all valves. Turn off and disconnect the vacuum pump.

(4) The refrigerant system is prepared to be charged with refrigerant.



**Fig. 3 Refrigerant Recovery Machine Hookup**

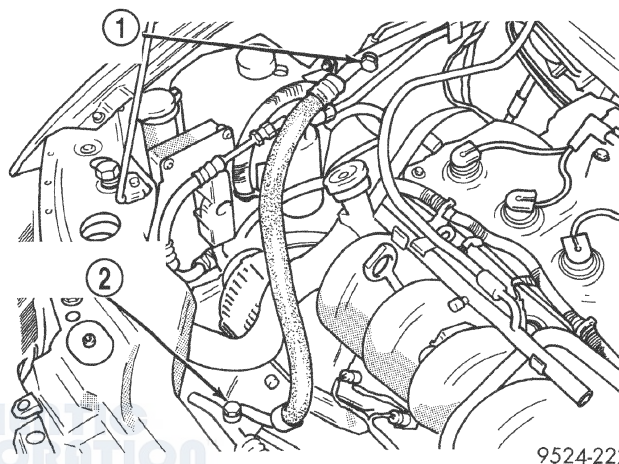
- 1 - SUCTION PORT
- 2 - DISCHARGE PORT
- 3 - A/C RECOVERY MACHINE

**R-134a REFRIGERANT**

This vehicle uses a new type of refrigerant called R-134a. It is a non-toxic, non-flammable, clear colorless liquified gas.

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 in a R-134a system could cause compressor failure, refrigerant oil sludging or poor performance. **Never add R-12 to a system designed to use R-134a. System failure will occur.**

Both of the service ports to charge the air conditioning system are located on the hoses (Fig. 4). New design of service ports have been used to ensure that the system is not accidentally filled with the wrong refrigerant (R-12).



**Fig. 4 A/C Service Ports**

- 1 - SUCTION LINE SERVICE PORT
- 2 - DISCHARGE LINE SERVICE PORT

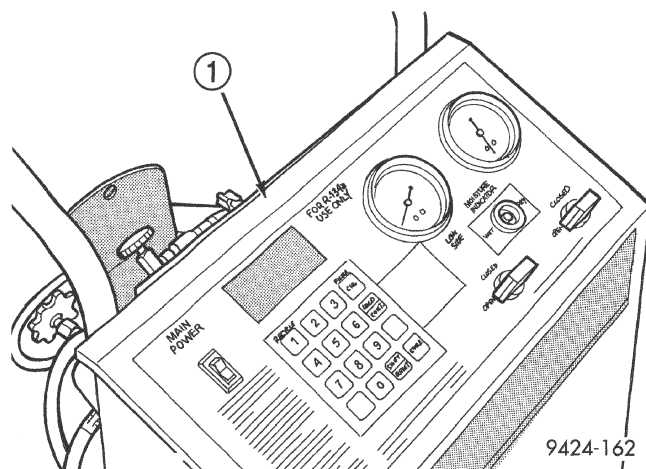
When servicing a system, it is required that an air conditioning charging recovery/recycling machine be used (Fig. 5). Contact an automotive service equipment supplier for proper equipment. Refer to the operating instructions provided with the equipment for proper operation.

A manifold gauge set (Fig. 6) must also be used in conjunction with the charging and/or recovery/recycling device. Only use gauges that have not been used for R-12. The service hoses on the gauge set should have manual (turn wheel) or automatic back flow valves at the service port connector ends. This will prevent refrigerant R-134a from being released into the atmosphere.

R-134a refrigerant requires a special type of compressor oil. When adding oil, make sure that it is designed to be used in a R-134a system. Refer to the label under the hood for proper oil and refrigerant charge levels (Fig. 7).

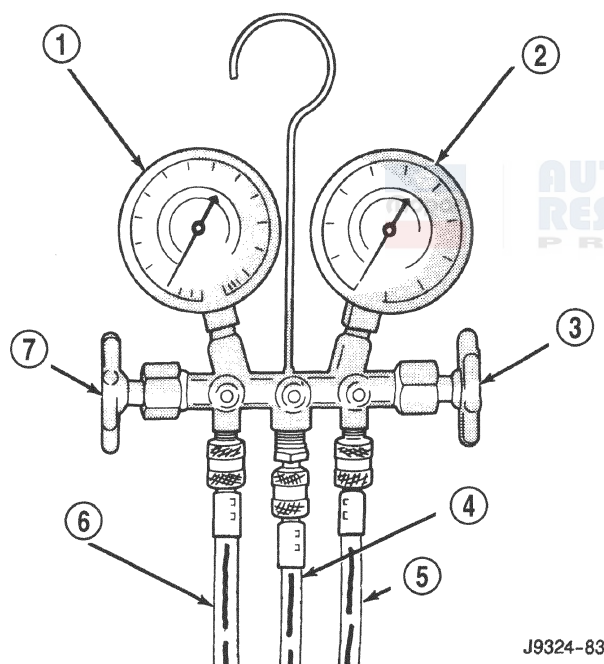
Due to the different characteristics of R-134a it requires all new service procedures.

## SERVICE PROCEDURES (Continued)



**Fig. 5 Refrigerant Recovery/Recycling Station - Typical**

1 - R-134a REFRIGERANT RECOVERY MACHINE



**Fig. 6 Manifold Gauge Set - Typical**

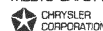
- 1 - LOW PRESSURE GAUGE
- 2 - HIGH PRESSURE GAUGE
- 3 - VALVE
- 4 - VACUUM/REFRIGERANT HOSE (YELLOW W/BLACK STRIP)
- 5 - HIGH PRESSURE HOSE (RED W/BLACK STRIP)
- 6 - LOW PRESSURE HOSE (BLUE W/BLACK STRIP)
- 7 - VALVE

**ATTENTION**

**R-134a** A/C REFRIGERANT  
FACTORY CHARGE 0.57Kg  
(20 oz./1.25 lbs.)  
SERVICE PART No. 82300101  
**SP15 PAG** COMPRESSOR OIL  
SERVICE PART No. 82300350

**WARNING: HIGH-PRESSURE REFRIGERANT SYSTEM TO BE SERVICED BY QUALIFIED PERSONNEL ONLY.**

CONSULT SERVICE MANUAL. IMPROPER SERVICE METHODS MAY CAUSE PERSONAL INJURY. SYSTEM MEETS SAFETY REQUIREMENTS OF SAE STANDARD J639.



80b8986b

**Fig. 7 Underhood Label**

**WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO RECLAIM R-134a SYSTEMS. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.**

**R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR and R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.**

The use of R-134a will have a positive environmental impact due to its zero ozone depletion and low global warming impact.

**SYSTEM CHARGE LEVEL****TO CHECK OR FILL SYSTEM**

The procedure below should be used to check and/or fill the refrigerant charge in the air conditioning system.

**NOTE:** The air conditioning system in this vehicle holds 0.54 Kg. (19 oz. or 1.19 lbs.) of R-134a refrigerant.

**NOTE:** The System Charge Level Specifications and Charge Determination Graph were not available at the time of printing. A Technical Service Bulletin will be issued for insertion into the manual when data becomes finalized.



**SERVICE PROCEDURES (Continued)****SYSTEM LEAK CHECKING**

**WARNING: R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. MIXTURE OF AIR and R-134a CAN BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.**

**AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.**

If the A/C system is not cooling properly, determine if the refrigerant system is fully charged with R-134a. This is accomplished by performing a system Charge Level-Check or Fill. If while performing this test A/C liquid line pressure is less than 345 kPa (50 psi) proceed to Empty Refrigerant System Leak Test. If liquid line pressure is greater than 345 kPa (50 psi) proceed to low refrigerant level leak test. If the refrigerant system is empty or low in refrigerant charge, a leak at any line fitting or component seal is likely. A review of the fittings, lines and components for oily residue is an indication of the leak location. To detect a leak in the refrigerant system, perform one of the following procedures as indicated by the symptoms.

**EMPTY REFRIGERANT SYSTEM LEAK TEST**

(1) Evacuate the refrigerant system to the lowest degree of vacuum possible (approx. 28 in Hg.). Determine if the system holds a vacuum for 15 minutes. If vacuum is held, a leak is probably not present. If system will not maintain vacuum level, proceed with this procedure.

(2) Prepare a .284 Kg. (10 oz.) refrigerant charge to be injected into the system.

(3) Connect and dispense .284 Kg. (10 oz.) of refrigerant into the evacuated refrigerant system.

(4) Proceed to Step 2 of Low Refrigerant Level Leak Test.

**LOW REFRIGERANT LEVEL LEAK TEST**

(1) Determine if there is any (R-134a) refrigerant in the system.

(2) Position the vehicle in a wind free work area. This will aid in detecting small leaks.

(3) Bring the refrigerant system up to operating temperature and pressure. This is done by allowing

the engine to run for five minutes with the system set to the following:

- Transaxle in Park
- Engine Idling at 700 rpm
- A/C Controls Set in 100 percent outside air
- Blower switch in the high A/C position
- A/C in the ON position
- Open all windows

**CAUTION: A leak detector designed for R-12 refrigerant (only) will not detect leaks in a R-134a refrigerant system.**

(4) Shut off the vehicle and wait 2 to 7 minutes. Then use an Electronic Leak Detector that is designed to detect R-134a type refrigerant and search for leaks. Fittings, lines, or components that appear to be oily usually indicates a refrigerant leak. To inspect the evaporator core for leaks, insert the leak detector probe into the drain tube opening or a heat duct.

**NOTE: A R-134a dye is available to aid in leak detection. Use only Chrysler approved refrigerant dye.**

If a thorough leak check has been completed without indication of a leak, proceed to System Charge Level.

**THERMOCOUPLE PROBE**

To diagnose the A/C system, a temperature probe is required to measure liquid line temperature. The clamp-on type K probe shown in this manual is available through the Chrysler Professional Service Equipment (PSE) program. This probe is compatible with temperature-measuring instruments that accept Type K Thermocouples and have a miniature connector input. Other temperature probes are available through aftermarket sources. All references in this manual will reflect the use of the probe made available through the Professional Service Equipment program.

In order to use the temperature probe, a digital thermometer will be required. If a digital thermometer is not available, an adapter is available through the Professional Service Equipment program. It can convert any standard digital multimeter into a thermometer. This adapter is designed to accept any standard K-type thermocouple.

If a digital multimeter is not available, it too can be ordered through Professional Service Equipment program.

## REMOVAL AND INSTALLATION

### SAFETY PRECAUTIONS AND WARNINGS

**WARNING:** WEAR EYE PROTECTION WHEN SERVICING THE AIR CONDITIONING REFRIGERANT SYSTEM. SERIOUS EYE INJURY CAN RESULT FROM EYE CONTACT WITH REFRIGERANT. IF EYE CONTACT IS MADE, SEEK MEDICAL ATTENTION IMMEDIATELY.

DO NOT EXPOSE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC TYPE LEAK DETECTOR IS RECOMMENDED.

LARGE AMOUNTS OF REFRIGERANT RELEASED IN A CLOSED WORK AREA WILL DISPLACE THE OXYGEN AND CAUSE SUFFOCATION.

THE EVAPORATION RATE OF REFRIGERANT AT AVERAGE TEMPERATURE AND ALTITUDE IS EXTREMELY HIGH. AS A RESULT, ANYTHING THAT COMES IN CONTACT WITH THE REFRIGERANT WILL FREEZE. ALWAYS PROTECT SKIN OR DELICATE OBJECTS FROM DIRECT CONTACT WITH REFRIGERANT. R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR.

SOME MIXTURES OF AIR and R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.

ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. SEEK MEDICAL ATTENTION IMMEDIATELY IF SWALLOWED OR INHALED. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN AND PETS.

DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT RUNNING TEMPERATURE. PERSONAL INJURY CAN RESULT.

**CAUTION:** The engine cooling system is designed to develop internal pressure of 97 to 123 kPa (14 to 18 psi). Allow the vehicle to cool a minimum of 15 minutes before opening the cooling system. Refer to Group 7, Cooling System.

### A/C PRESSURE TRANSDUCER

**CAUTION:** A/C pressure transducer switch connector terminal contacts can be damaged by probing

tools during system diagnosis and repair. Failure to use their respective mating terminals or pin gauge to check for tightness will cause contact beam spreads. This will result in loss of continuity.

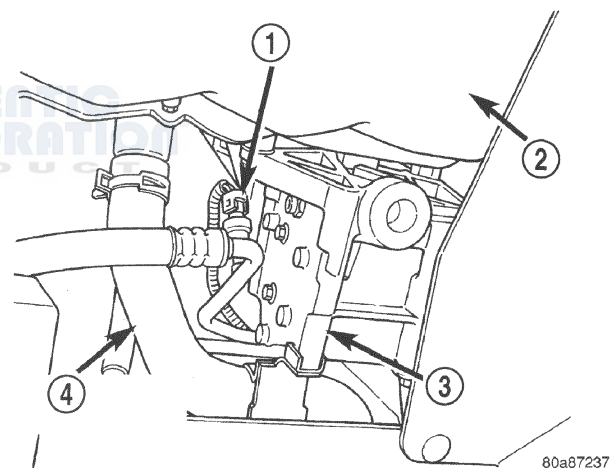
**NOTE:** O-ring replacement is required whenever the pressure transducer is serviced. Be sure to use the O-ring specified for this vehicle.

### REMOVAL

- (1) If equipped with a 2.4L engine, hoist vehicle.
- (2) Disconnect the wire harness connector from the A/C pressure transducer.

**NOTE:** A slight release of pressure trapped in the fitting may be experienced. It is not necessary to discharge the refrigerant system.

- (3) Remove the transducer with a counterclockwise rotation using a 14 mm open-end wrench (Fig. 8) and (Fig. 9).



**Fig. 8 Pressure Transducer (2.4L engine, viewed from beneath vehicle)**

- 1 - A/C PRESSURE TRANSDUCER
- 2 - OIL PAN
- 3 - A/C COMPRESSOR
- 4 - LOWER RADIATOR HOSE

### INSTALLATION

For installation, reverse above procedures. Tighten pressure transducer to 6 N·m (50 in. lbs.).

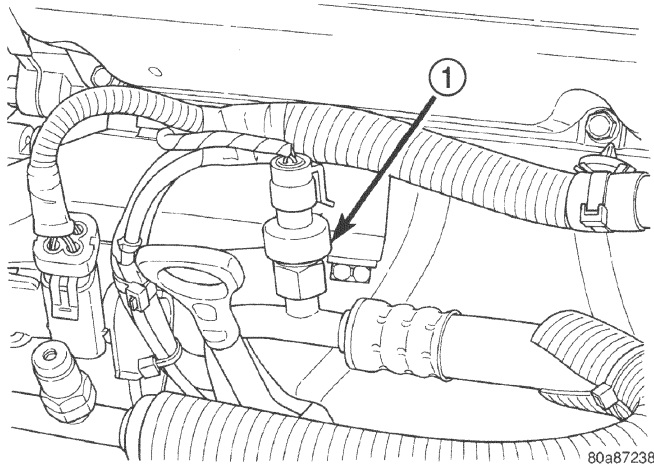
### BLOWER MOTOR AND WHEEL ASSEMBLY

The blower motor is located on the right side of the heater housing.

### REMOVAL

- (1) Disconnect battery.
- (2) Remove lower right under panel silencer duct.



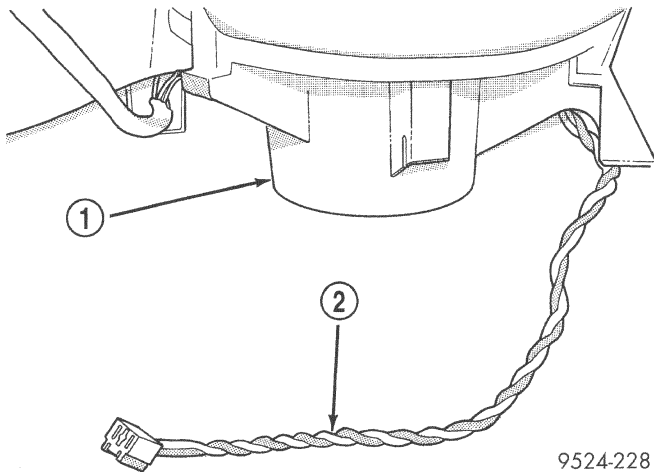
**REMOVAL AND INSTALLATION (Continued)****Fig. 9 Pressure Transducer (2.5L engine)**

1 - A/C PRESSURE TRANSDUCER

- (3) Remove blower motor connector from resistor block (Fig. 10).
- (4) Remove blower motor case retaining screws.
- (5) Lower blower motor case from housing (Fig. 11).
- (6) Remove fan scroll from motor shaft.
- (7) Remove motor from motor case.

**INSTALLATION**

For installation, reverse the above procedures.

**Fig. 10 Blower Motor Wiring**

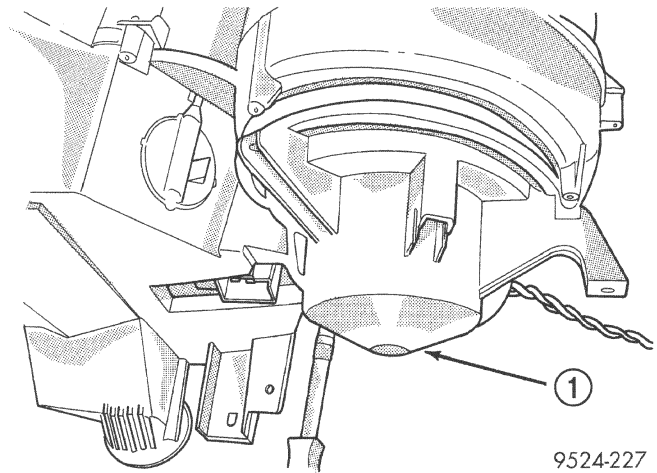
1 - BLOWER MOTOR  
2 - BLOWER MOTOR WIRING

**BLOWER MOTOR RESISTOR**

The blower motor resistor is located on the lower right side of the heater housing.

**REMOVAL**

- (1) Remove lower right underpanel silencer/duct.

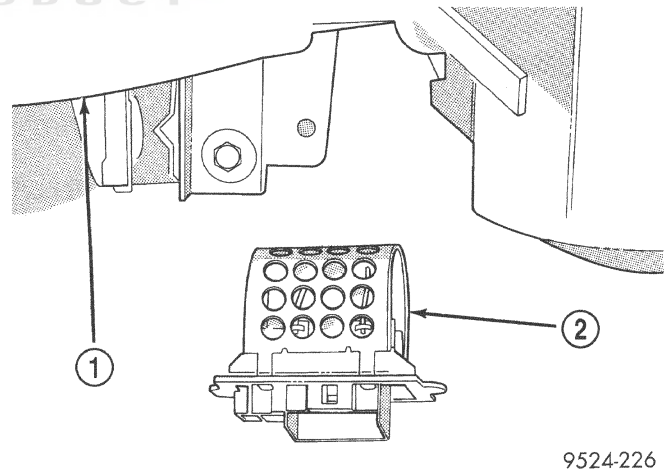
**Fig. 11 Blower Motor**

1 - BLOWER MOTOR

- (2) Disconnect wiring connectors on blower motor resistor.
- (3) Remove blower motor resistor retaining screws.
- (4) Pull blower motor resistor out of heater housing (Fig. 12).

**INSTALLATION**

For installation, reverse the above procedures.

**Fig. 12 Blower Motor Resistor**

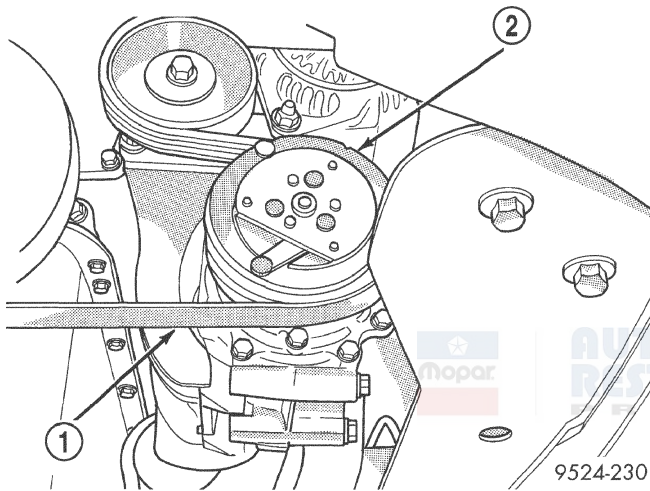
1 - A/C HOUSING  
2 - BLOWER MOTOR RESISTOR

**BLOWER MOTOR WHEEL**

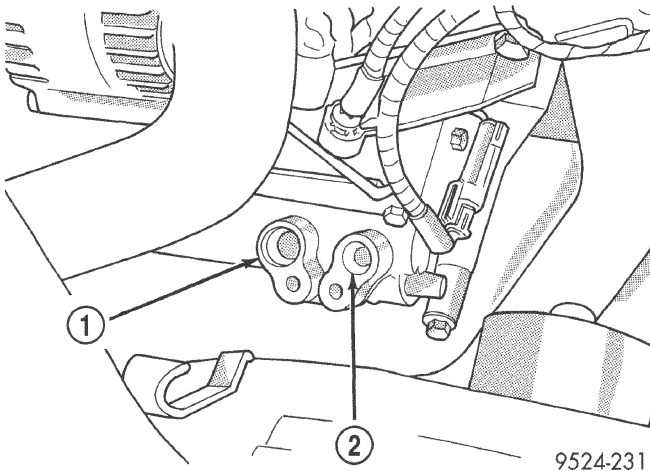
The blower motor wheel is only serviced with the blower motor. The wheel and the motor are balanced as an assembly. If the blower motor wheel requires replacement, the blower motor must also be replaced. Refer to blower motor for replacement procedure.

**REMOVAL AND INSTALLATION (Continued)****COMPRESSOR****REMOVAL**

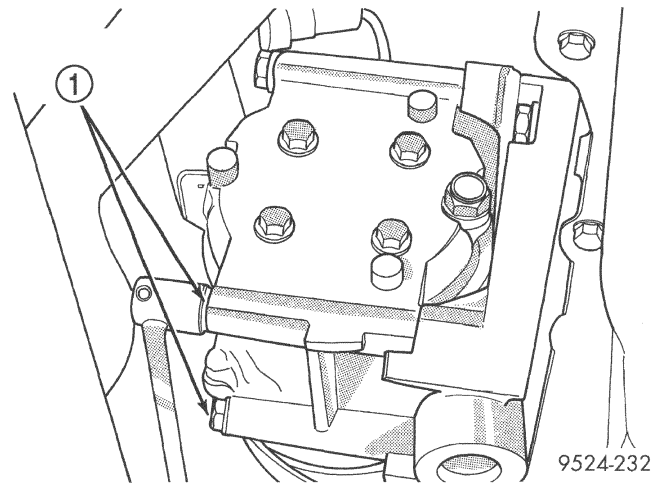
- (1) Disconnect the battery negative remote cable.
- (2) Loosen and remove drive belt (Fig. 13). Refer to Group 7, Engine Cooling.
- (3) Disconnect compressor clutch wire lead.
- (4) Recover refrigerant system with R-134a recovery unit.
- (5) Remove refrigerant lines from compressor (Fig. 14).
- (6) Remove compressor attaching bolts (Fig. 15) and (Fig. 16).
- (7) Remove compressor (Fig. 17).

**Fig. 13 Drive Belt**

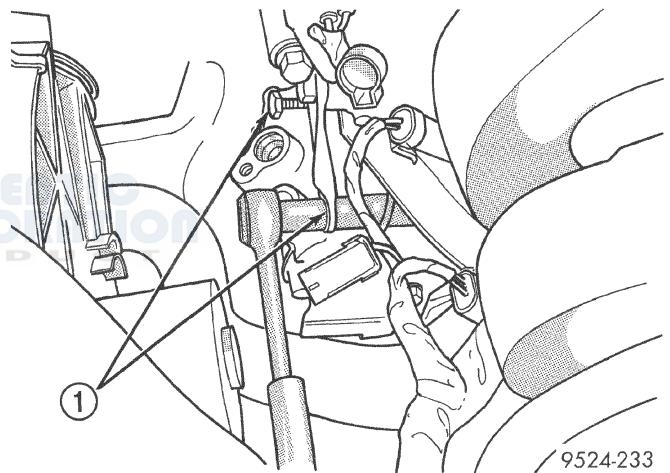
- 1 - DRIVE BELT  
2 - A/C COMPRESSOR

**Fig. 14 A/C Lines**

- 1 - SUCTION PORT  
2 - DISCHARGE PORT

**Fig. 15 Lower Attaching Bolts**

- 1 - LOWER MOUNTING BOLTS

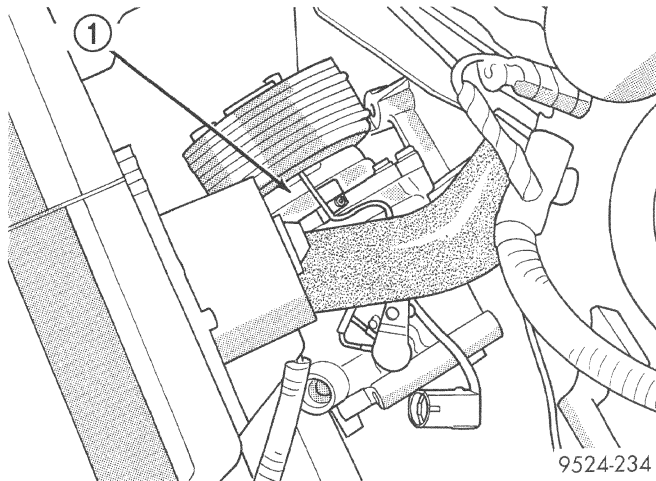
**Fig. 16 Upper Attaching Bolts**

- 1 - UPPER MOUNTING BOLTS

**INSTALLATION**

- (1) Position the compressor on the mount.
- (2) Install the compressor attaching bolts. Tighten bolts to 41 N·m (30 ft. lbs.) torque.
- (3) Install drive belt (refer to Group 7, Cooling System).
- (4) Install refrigerant hoses and new seals.
- (5) Connect the clutch wire.
- (6) Charge the system.
- (7) Connect the negative cable to the battery.

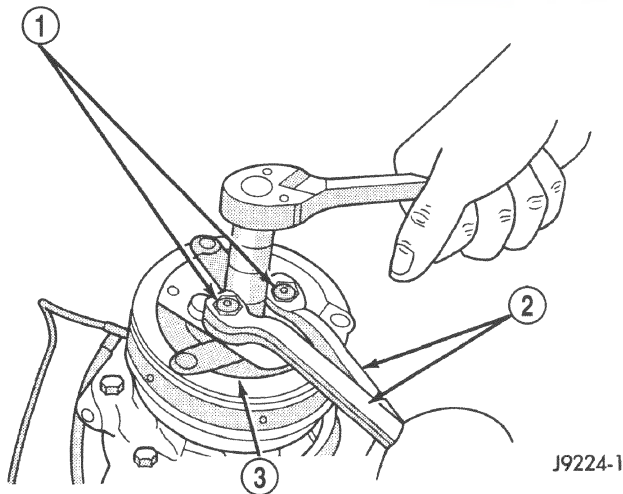


**REMOVAL AND INSTALLATION (Continued)****Fig. 17 Compressor Removal**

1 - COMPRESSOR

**COMPRESSOR CLUTCH/COIL ASSEMBLY****REMOVAL**

- (1) Remove the compressor from the mount.
- (2) Install two (6 mm) bolts into the threaded holes in the armature plate. Hold bolts with two wrenches to prevent shaft from turning (Fig. 18). Remove compressor shaft nut.

**Fig. 18 Compressor Shaft Nut Removal/Installation**

1 - BOLTS  
2 - BOX-END WRENCHES  
3 - ARMATURE PLATE

- (3) Lightly tap clutch plate with a plastic hammer and remove plate and shim(s) (Fig. 19).

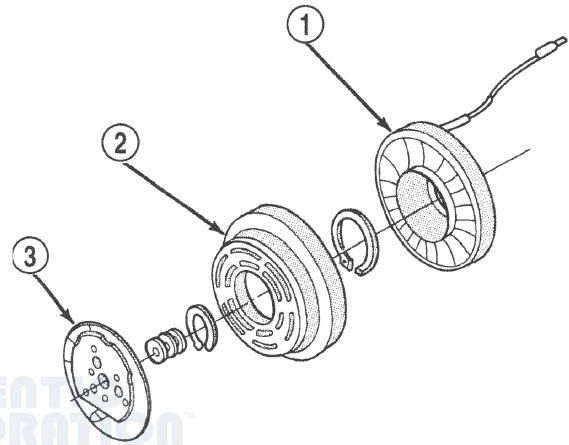
**CAUTION:** Do not use screwdrivers between the armature plate assembly and rotor-pulley to remove the armature plate. This may damage the armature plate assembly.

- (4) Remove pulley retaining snap ring with snap ring pliers. Remove pulley assembly from compressor. Use a plastic hammer, if necessary.

- (5) Loosen the lead wire retaining clamps and remove lead wire from the compressor front end cover. Disconnect the lead wire from the thermal limiter switch.

- (6) Remove snap ring which secures field coil-core assembly to the front cover (Fig. 19). Note the alignment of field coil-core assembly when removing.

**WARNING:** TAKE CARE THAT THE SNAP RING DOES NOT FLY OUT FROM THE GROOVE.

**Fig. 19 Clutch Plate/Pulley/Field Coil**

1 - FIELD COIL-CORE  
2 - ROTOR-PULLEY  
3 - ARMATURE PLATE

**INSPECTION**

Examine frictional faces of the rotor-pulley and armature plate for wear. The pulley and plate should be replaced if there is excessive wear or scoring. If the friction surfaces are oily, inspect the shaft nose area of the compressor for excess oil. If excess oil is present, the shaft seal is leaking and the compressor must be replaced.

Check pulley hub bearing for roughness or excessive grease leakage. Check for bearing grease contamination on armature plate faces.

**CAUTION:** The pulley and clutch plate were mated at the factory by a burnishing operation. No attempt should be made to separately replace either part. This will result in clutch slippage due to insufficient contact area.

## REMOVAL AND INSTALLATION (Continued)

### INSTALLATION

(1) Position the back of the field coil on the compressor front cover. Be sure the locating nipple on the back of the coil lines up with the locating indentation on the front cover. This ensures correct position of the coil and lead wire.

(2) Fasten lead wire to the compressor front cover with the retaining clip. Connect the lead wire to the thermal limiter switch.

(3) Install field coil retaining snap ring (bevel side outward) with snap ring pliers. Insure snap ring is properly seated into groove.

**CAUTION:** If snap rings on field coil or pulley assembly are not fully seated, they will vibrate out. A clutch failure and possible severe damage to the compressor could result.

(4) Position pulley assembly onto compressor.

**CAUTION:** Do not mar the pulley frictional surface.

(5) Install pulley assembly retaining snap ring (bevel side outward) with snap ring pliers. Insure snap ring is properly seated into groove.

(6) Place a trial stack of shims, 2.54 mm (0.10 in.) thick, on the compressor shaft.

(7) Install clutch plate on compressor shaft. Note the machined mating splines (Fig. 20).

(8) With the front clutch plate assembly tight against the shims, measure the air gap between clutch plate and pulley face with feeler gauges (Fig. 21). The air gap should be between 0.35 and 0.65 mm (0.013 and 0.025 inch). If proper air gap is not obtained, add or subtract shims until desired air gap is obtained.

(9) Install compressor shaft nut. Tighten nut to 17.6 N·m (13 ft. lbs.) torque.

(10) Shims may compress after tightening shaft bolt. Check air gap in four or more places to verify if air gap is still correct. Spin pulley for final check.

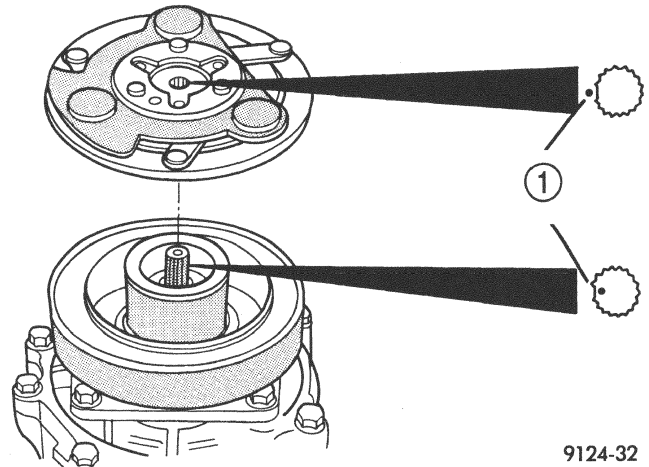
(11) Install the compressor onto the mount.

### CLUTCH BREAK-IN

After installing a new field coil-core, check for correct voltage/ampereage. Cycle the A/C clutch approximately 20 times (5 seconds on and 5 seconds off). For this procedure run engine at 1,500 to 2,000 rpm and set the system to MAX A/C mode. This procedure will seat the opposing friction surfaces and provide a higher clutch torque capability.

### CONDENSER

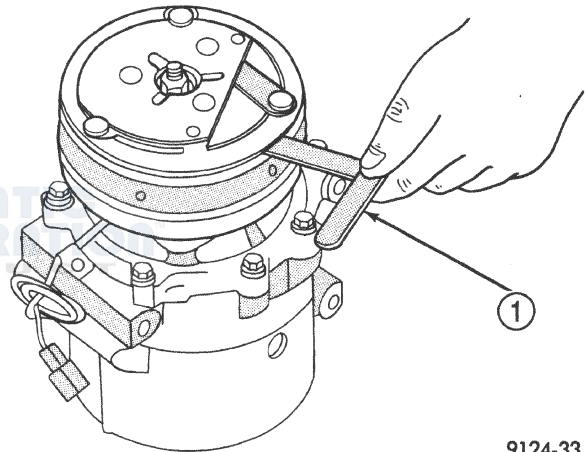
The condenser is located between the radiator and the front bumper. The condenser can be serviced without having to drain the cooling system or remove the radiator.



9124-32

**Fig. 20 Aligning Clutch Plate Splines**

1 - MATING MARK: WHERE THERE IS NO SPLINE



9124-33

**Fig. 21 Measuring Air Gap**

1 - FEELER GAUGE

**WARNING:** AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO RECOVER R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.

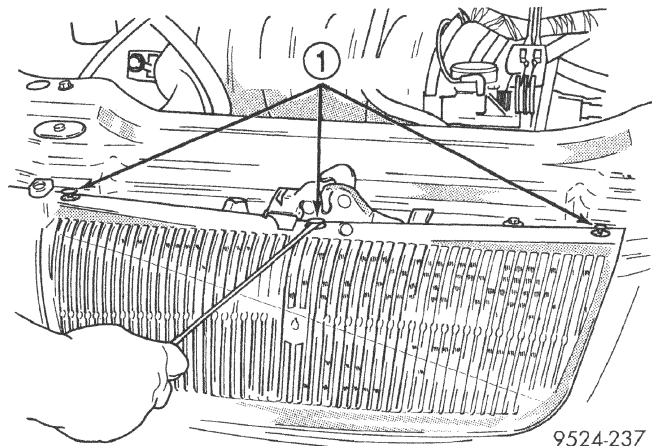
R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.



**REMOVAL AND INSTALLATION (Continued)****REMOVAL**

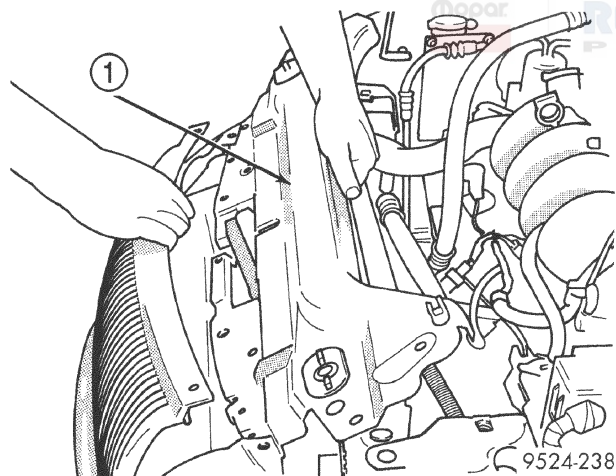
(1) Remove refrigerant from the A/C system using a refrigerant recovery machine.

(2) Remove grille retainers (Fig. 22). Refer to Group 23, Body for removal procedures.

**Fig. 22 Grille Retainers**

1 - GRILLE RETAINERS

(3) Remove upper radiator support crossmember (Fig. 23).

**Fig. 23 Radiator Support Crossmember**

1 - UPPER RADIATOR CROSSMEMBER

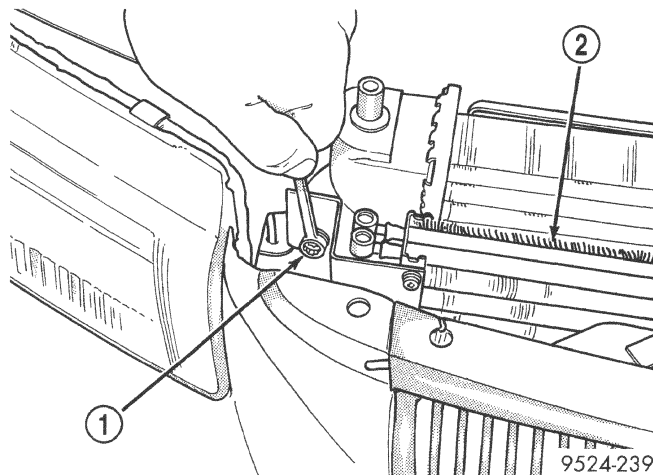
- (4) Disconnect and cap A/C lines at the condenser.
- (5) Remove condenser line support bracket.
- (6) Remove condenser mounting bolts (Fig. 24).

**CAUTION:** Avoid bending or breaking condenser inlet tube when lifting condenser from the vehicle.

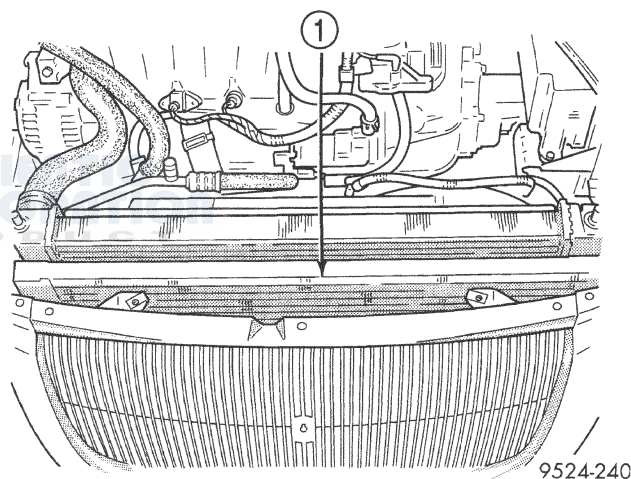
- (7) Lift condenser from vehicle (Fig. 25).

**INSTALLATION**

For installation, reverse above procedures.

**Fig. 24 Condenser Mounting**

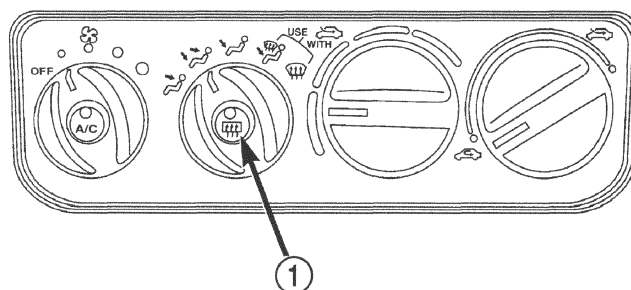
1 - CONDENSER MOUNTING  
2 - CONDENSER

**Fig. 25 Condenser Removal**

1 - CONDENSER

**CONTROL MODULE**

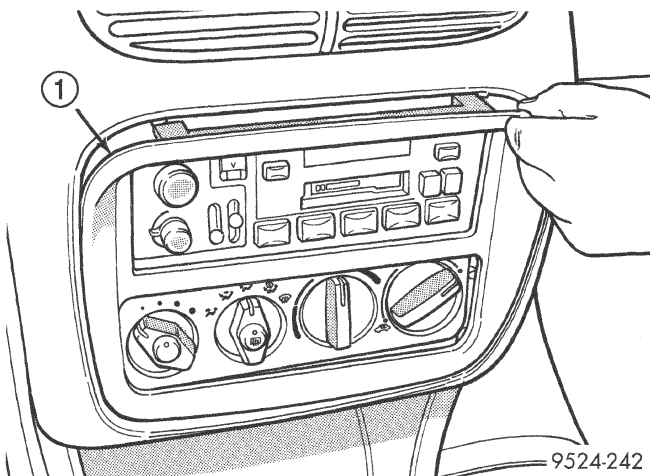
The control module is located below the radio.

**Fig. 26 HVAC Control Module**

1 - REAR WINDOW DEFOGGER SWITCH

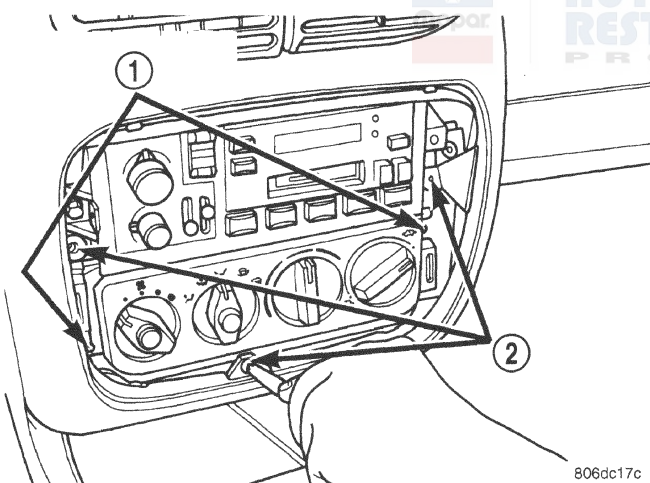
**REMOVAL AND INSTALLATION (Continued)****REMOVAL**

- (1) Place the ignition key in the OFF position before removing control module.
- (2) Remove trim bezel (Fig. 27).

**Fig. 27 Control Module**

1 - TRIM BEZEL

- (3) Remove cluster hood bezel retaining screws in the trim bezel opening (Fig. 28).

**Fig. 28 Control Module Screws**

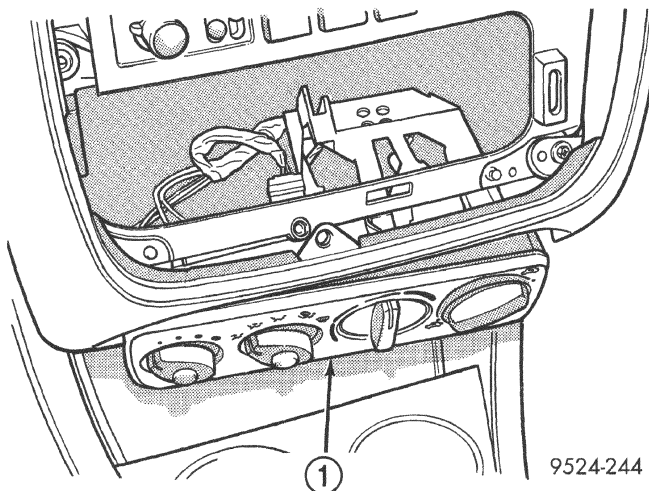
1 - CONTROL MODULE SCREWS  
2 - CLUSTER HOOD SCREWS

- (4) Pry up the cluster hood bezel a few inches to expose the cubby bin/cigar lighter bezel screws.

- (5) Remove the cubby bin/cigar lighter bezel and wiring.

- (6) Remove the control module retaining screws.

- (7) Drop the A/C control module into the cigar lighter/cubby bin bezel opening (Fig. 29). Then disconnect the wiring on the rear of the control module.

**Fig. 29 Control Module At Bezel Opening**

1 - CONTROL MODULE

- (8) Release the cable clips from the top of the control module. Retain the clips for future use. Then disconnect the temperature control and recirculation control cables.

- (9) Remove the control module.

**INSTALLATION**

For installation, reverse the above procedures. Verify that the cables are properly adjusted and the module is seated properly.

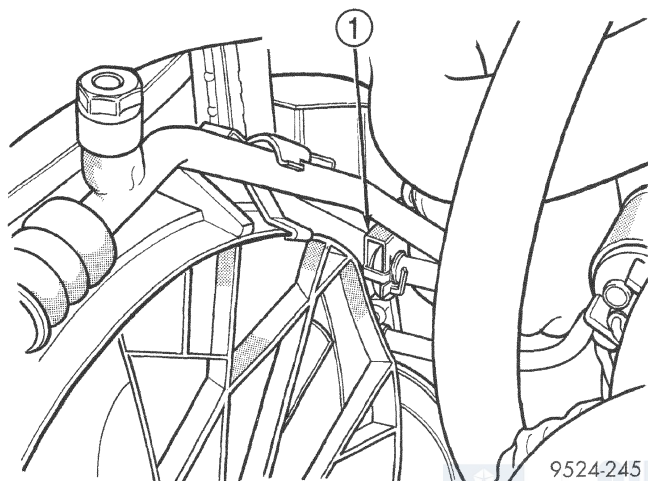
**CABLE ADJUSTMENT**

The cables must be adjusted for proper function of the control module. To adjust the cable, attach the cable to the lever arm of the control module. Turn the knob fully counterclockwise. Pull the cable jacket away from the cable end until taut. Clip the cable jacket to the control module. The knob should travel a full 180° if the cable is properly adjusted.

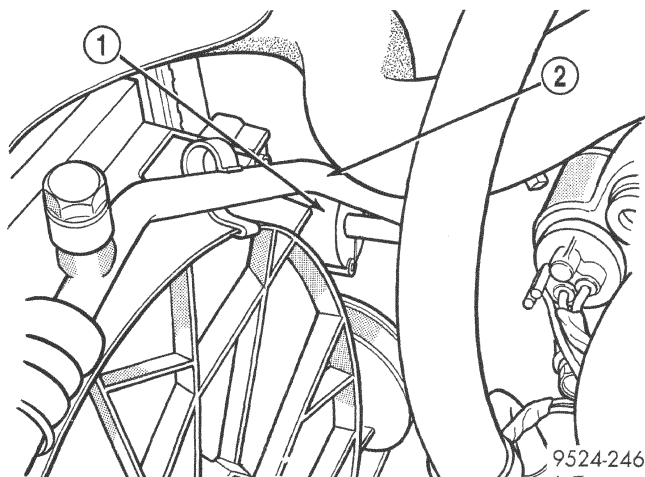


**REMOVAL AND INSTALLATION (Continued)****DISCHARGE LINE****REMOVAL**

- (1) Remove refrigerant from the A/C system using a refrigerant recovery machine.
- (2) Disconnect A/C pressure transducer wire harness.
- (3) Remove quick connect clip and disconnect quick connect at condenser using Special Tool kit 7193 (Fig. 30) and (Fig. 31).

**Fig. 30 Quick Connect Clip**

1 - DISCHARGE LINE CLIP

**Fig. 31 Special Tool For Line At Condenser**

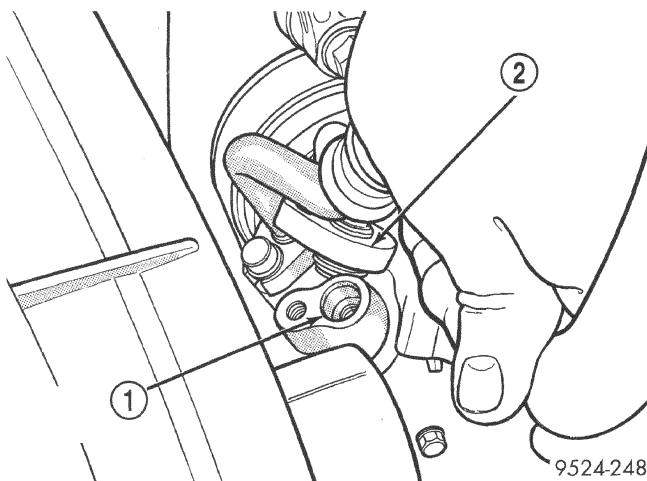
1 - SPECIAL TOOL OTC 7241  
2 - DISCHARGE LINE

**CAUTION:** Cap all lines that are not being replaced and cap the expansion valve tubes.

- (4) Disconnect line at A/C compressor (Fig. 32). Remove discharge line.

**INSTALLATION**

For installation, reverse the above procedures. Tighten bolts to 22 N·m (200 in. lbs.).

**Fig. 32 Line at Compressor**

1 - DISCHARGE PORT  
2 - DISCHARGE LINE

**EVAPORATOR**

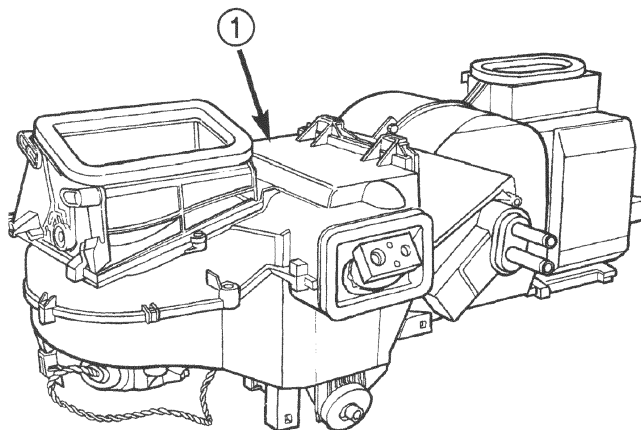
The Heater A/C housing must be removed from the vehicle when replacing the evaporator.

**REMOVAL**

- (1) Disconnect battery negative remote cable.

**CAUTION:** The refrigerant must be removed from the system before removing Heater-A/C housing. Use a refrigerant recovery machine.

- (2) Remove A/C housing from vehicle (Fig. 33). Refer to Heater-A/C Housing Removal and Installation in this section for procedure.

**Fig. 33 A/C Housing**

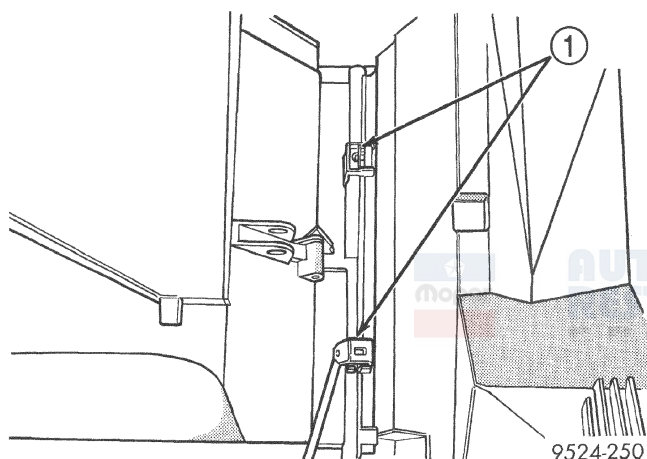
1 - HVAC MODULE

**REMOVAL AND INSTALLATION (Continued)**

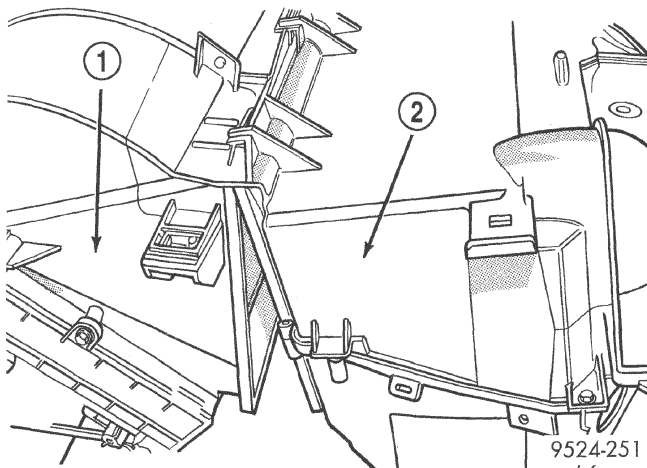
- (3) Remove recirculation door inlet cover.
- (4) Remove evaporator temperature probe.
- (5) Remove clips retaining evaporator housing to heater/distribution housing (Fig. 34).
- (6) Separate evaporator housing from heater/distribution housing (Fig. 35) and (Fig. 36).
- (7) Remove seal around evaporator tube inlet.
- (8) Remove evaporator housing upper cover (Fig. 37).
- (9) Lift evaporator out of lower housing (Fig. 38).
- (10) Remove styrofoam seal around evaporator.
- (11) Transfer evaporator sensor. Place the evaporator sensor in the same location as on the previous evaporator.

**INSTALLATION**

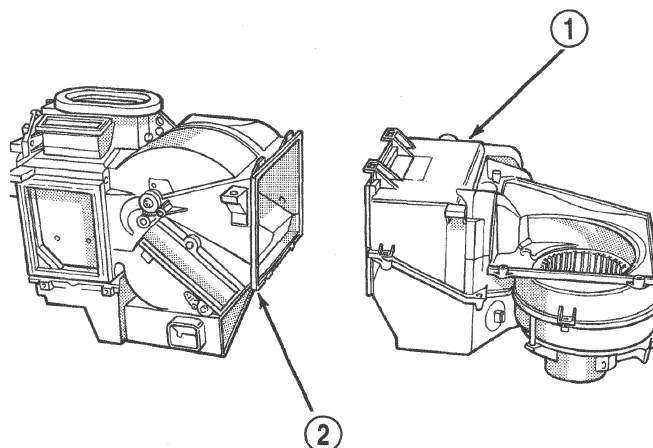
For installation, reverse the above procedure.

**Fig. 34 Housing Clips**

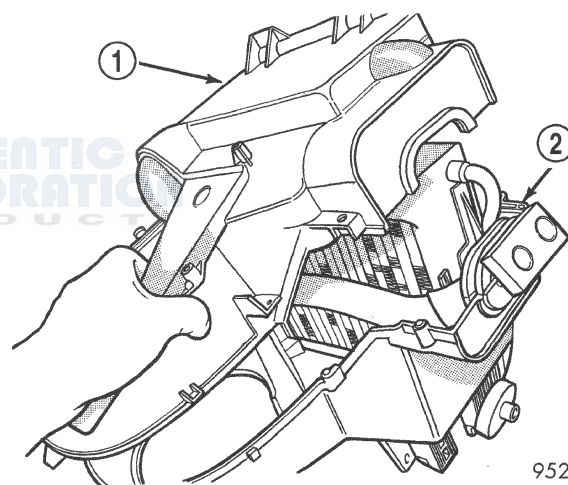
1 - HOUSING CLIPS

**Fig. 35 Separate Housings**

1 - HEATER HOUSING  
2 - EVAPORATOR HOUSING

**Fig. 36 Housings**

1 - EVAPORATOR HOUSING  
2 - HEATER DISTRIBUTION HOUSING

**Fig. 37 Evaporator Housing Upper Cover**

1 - EVAPORATOR HOUSING COVER  
2 - EVAPORATOR HOUSING

**EVAPORATOR PROBE****REMOVAL**

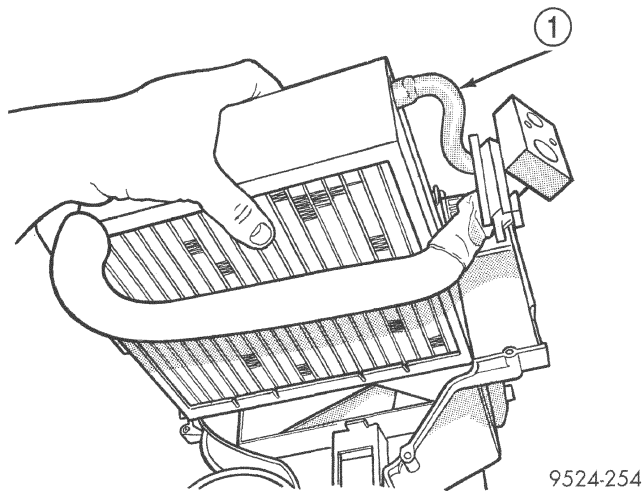
- (1) Disconnect battery.
- (2) Remove right under panel silencer/duct.
- (3) Disconnect wiring connector for evaporator probe (Fig. 39).
- (4) Using a flat blade pry tool, pull back on the locking tab. Twist the access plate clockwise one-quarter turn and remove plate (Fig. 40).
- (5) Pull probe out of evaporator core (Fig. 41). This plate must be pushed inside the A/C unit and orientated in such a way that the plate can be removed.

9524-252

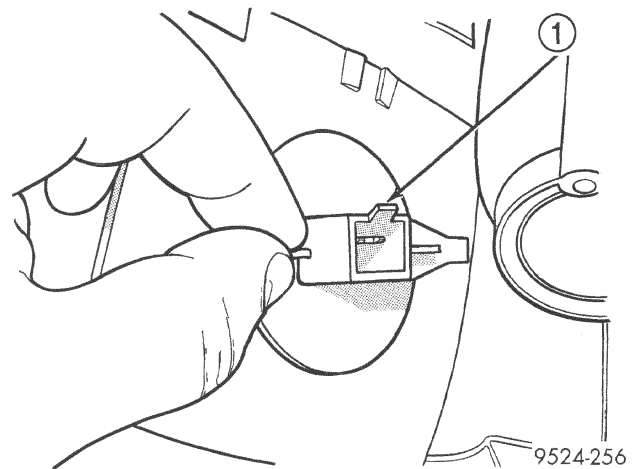
9524-250

9524-253

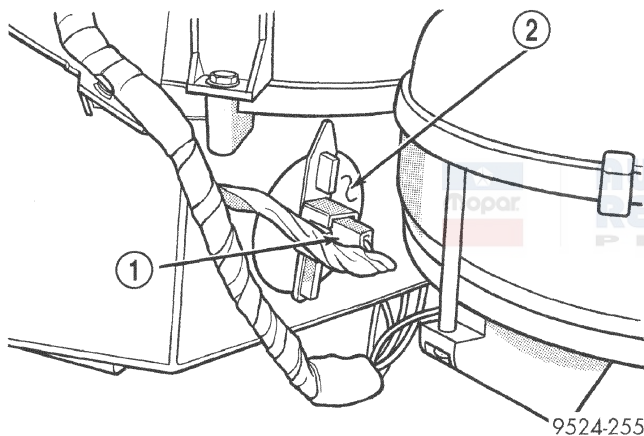
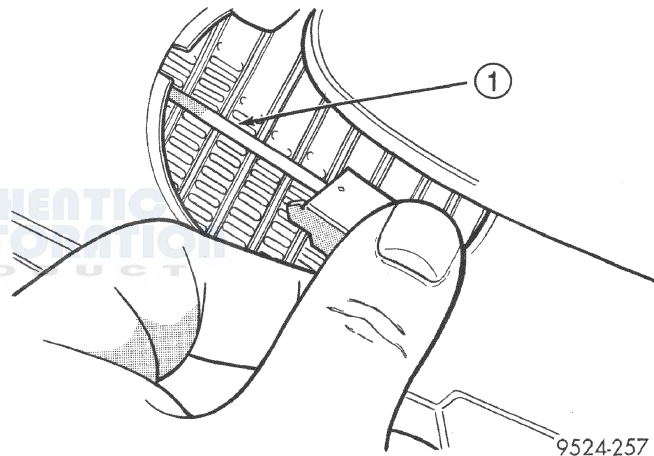
9524-251

**REMOVAL AND INSTALLATION (Continued)****Fig. 38 Remove Evaporator From Housing**

1 - EVAPORATOR

**Fig. 40 Evaporator Probe**

1 - EVAPORATOR PROBE

**Fig. 39 Evaporator Probe Wiring**1 - PROBE CONNECTOR  
2 - EVAPORATOR PROBE**Fig. 41 Remove Probe**

1 - EVAPORATOR PROBE NEEDLE

**INSTALLATION**

(1) Install new probe into the evaporator. **The new probe must not go into the same hole (in the evaporator core) that the old probe was removed.** The evaporator is manufactured with three holes for probe insertion. Insert the probe in the uppermost hole.

- (2) Install evaporator probe access panel.
- (3) Connect probe wiring harness.
- (4) Reconnect battery.

**EXPANSION VALVE**

**WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.**

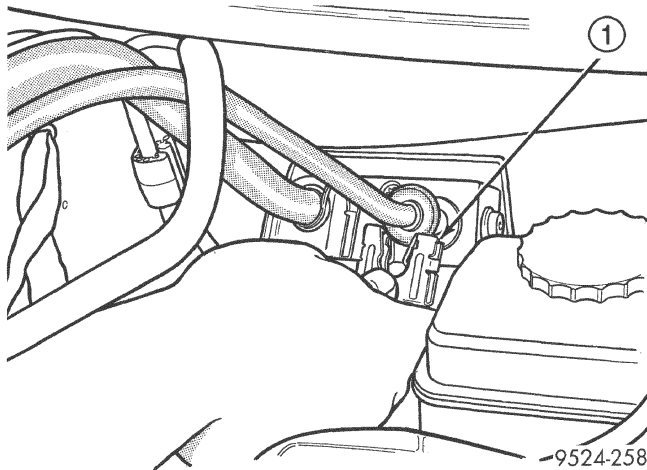
R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.



## REMOVAL AND INSTALLATION (Continued)

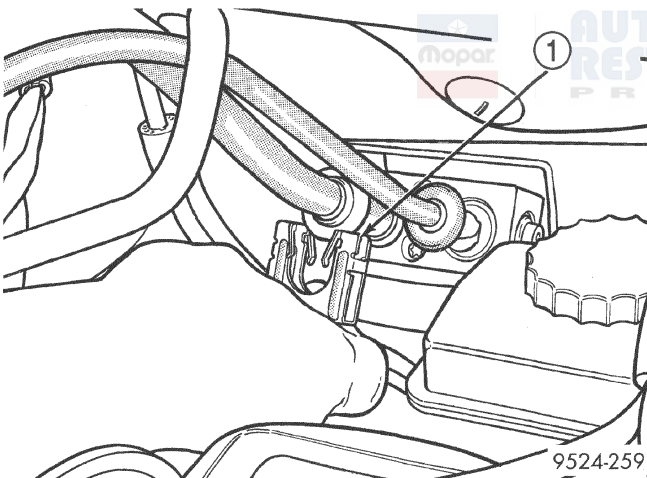
### REMOVAL

- (1) Remove refrigerant from the A/C system using a refrigerant recovery machine.
- (2) Disconnect clips from expansion valve lines (Fig. 42) and (Fig. 43).



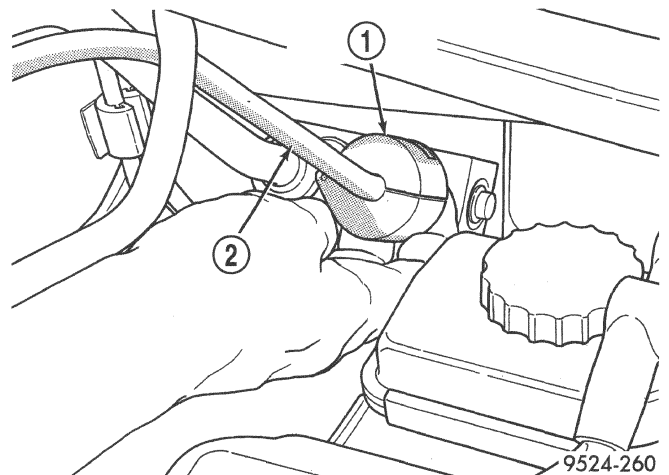
**Fig. 42 Liquid Line Clip**

1 - LIQUID LINE CLIP



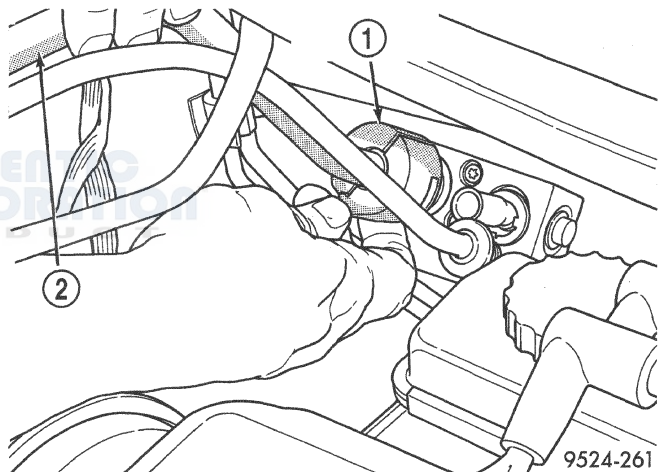
**Fig. 43 Suction Line Clip**

1 - SUCTION LINE CLIP



**Fig. 44 Special Tool 7240 For Liquid Line**

1 - SPECIAL TOOL OTC 7240  
2 - LIQUID LINE



**Fig. 45 Special Tool 7242 For Suction Line**

1 - SPECIAL TOOL OTC 7242  
2 - SUCTION LINE

- (3) Use special tool kit 7193 to disconnect quick connectors on expansion valve (Fig. 44) and (Fig. 45).
- (4) Remove lines at expansion valve (Fig. 46).
- (5) Remove two retaining bolts from expansion valve (Fig. 47).
- (6) Remove expansion valve (Fig. 48).
- (7) Remove expansion valve gasket.

### INSTALLATION

**CAUTION:** Always install a new gasket when replacing expansion valve.

For installation, reverse the above procedures. Tighten new expansion valve to 11 N·m (100 in. lbs.).

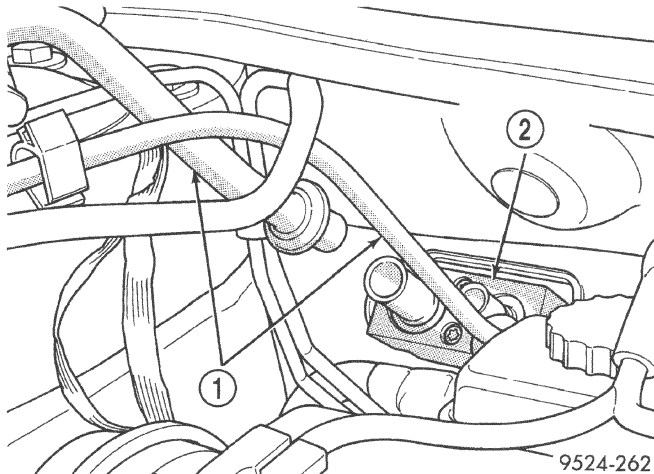
### FILTER/DRIER

The filter/drier is a receiver for reserve refrigerant. It also has a desiccant bag and a filter. This is used to absorb moisture and filter the refrigerant as it passes through the filter/drier.

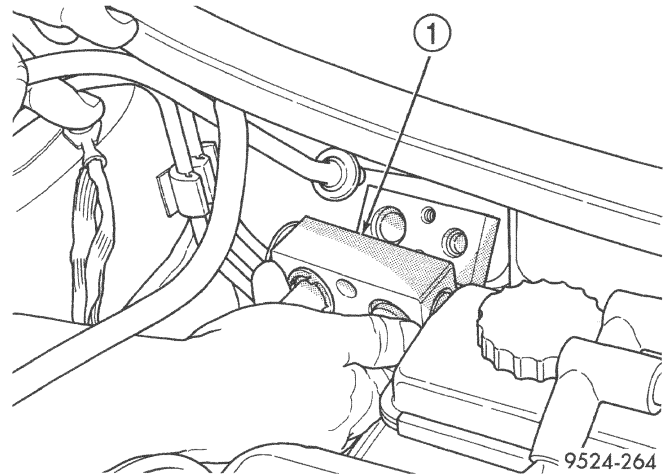
The filter/drier is located left of the coolant bottle (Fig. 49). The A/C refrigerant must be removed from the system before removing the filter/drier. Always use a refrigerant recovery machine.

Replace the filter/drier if an A/C system is left open for an extended period of time.

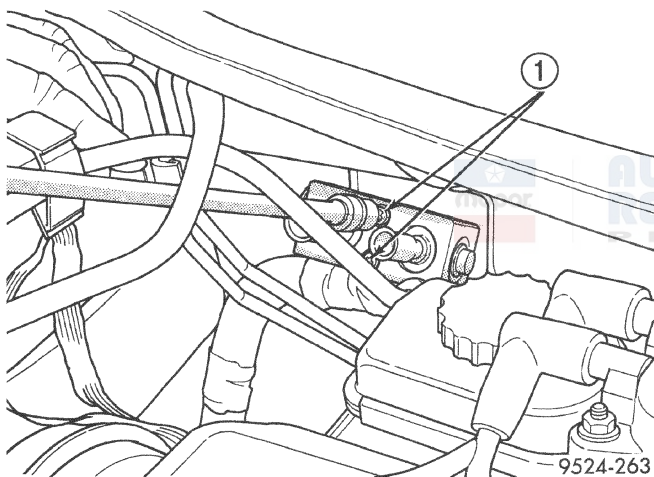


**REMOVAL AND INSTALLATION (Continued)****Fig. 46 Lines At Expansion Valve**

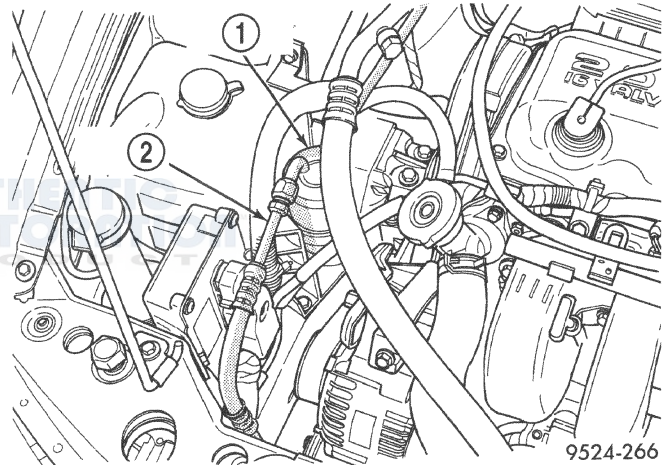
- 1 - A/C LINES
- 2 - EXPANSION VALVE

**Fig. 48 Expansion Valve**

- 1 - EXPANSION VALVE

**Fig. 47 Expansion Valve Bolts**

- 1 - EXPANSION VALVE MOUNTING SCREWS

**Fig. 49 Filter/Drier Location**

- 1 - RECEIVER DRIER
- 2 - LIQUID LINE

**REMOVAL**

(1) Remove refrigerant from A/C system using a refrigerant recovery machine.

(2) Remove liquid line at filter/drier from condenser (Fig. 50).

(3) Remove liquid line at filter/drier from expansion valve (Fig. 51).

(4) Remove filter/drier bracket bolt at base of filter/drier (Fig. 52).

(5) Cap liquid line and condenser threaded fitting while system is open to prevent moisture from entering system.

**INSTALLATION**

**CAUTION:** When installing new filter/drier do not leave open to atmosphere for a long period of time.

**The filter/drier contains moisture absorbing materials which will absorb moisture in the atmosphere.**

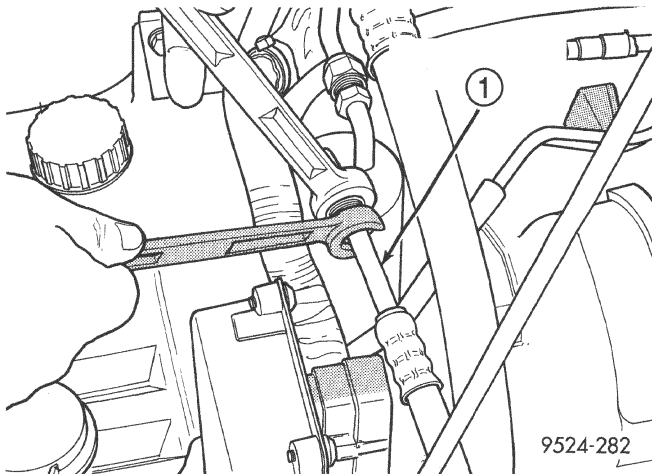
For installation, reverse the above procedures.

**HEATER CORE**

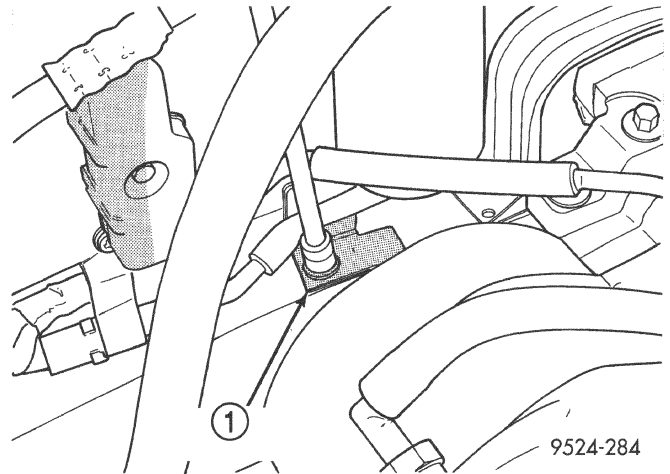
The heater core is serviceable inside the vehicle. However, if the core has leaked a significant amount of coolant, the A/C housing must be removed. The housing should be disassembled and cleaned thoroughly before heater core replacement. If housing removal is necessary, refer to Heater-A/C Housing, Removal and Installation in this section.

**REMOVAL**

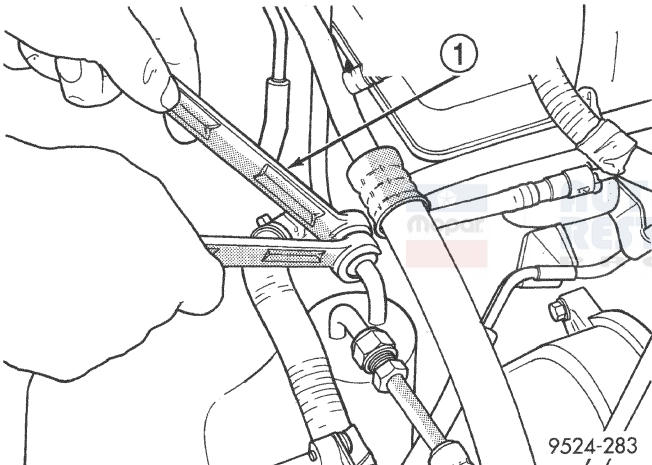
- (1) Disconnect battery negative remote cable.
- (2) Remove radio/control module bezel (Fig. 27).

**REMOVAL AND INSTALLATION (Continued)****Fig. 50 Liquid Line From Condenser**

1 - LIQUID LINE TO CONDENSER

**Fig. 52 Receiver/Drier Bracket**

1 - RECEIVER/DRIER BRACKET

**Fig. 51 Liquid Line From Expansion Valve**

1 - LIQUID LINE TO EXPANSION VALVE

- (3) Remove right instrument panel side trim.
- (4) Remove two screws at lower right side support beam.
- (5) Remove bolt for instrument panel support at A-pillar.
- (6) Remove left instrument panel side trim.
- (7) Remove upper instrument panel bezel.
- (8) Remove lower knee bolster.
- (9) Remove console screws at instrument panel.
- (10) Remove gearshift knob.
- (11) Remove shifter bezel.
- (12) Remove console screws at rear. Remove rear half of console.
- (13) Remove front console screws. Remove front half of console.
- (14) Remove right side instrument panel support strut.
- (15) Drain coolant.

- (16) Remove heater hoses at cowl.
- (17) Remove heater core cover screws and cover.
- (18) Remove heater core.

**INSTALLATION**

- (1) Carefully install new heater core into the heater housing.
- (2) Fasten heater core cover to housing with screws provided.
- (3) Reinstall all necessary trim.
- (4) Fill coolant to level.
- (5) Reconnect battery.

**HEATER HOSES**

The heater hoses attach at the engine compartment cowl onto the heater core inlet/outlet and on the left side of the engine.

**HEATER HOSES (2.0L-2.4L)**

The heater hoses are serviced separately of each other. The hoses can not be serviced with bulk roll heater hose. If it is necessary to replace a hose, use hose of the exact diameter and size and shape. The hoses are attached using spring tension clamps.

**REMOVAL**

**NOTE: Review Safety Precautions and Warnings before proceeding with this operation.**

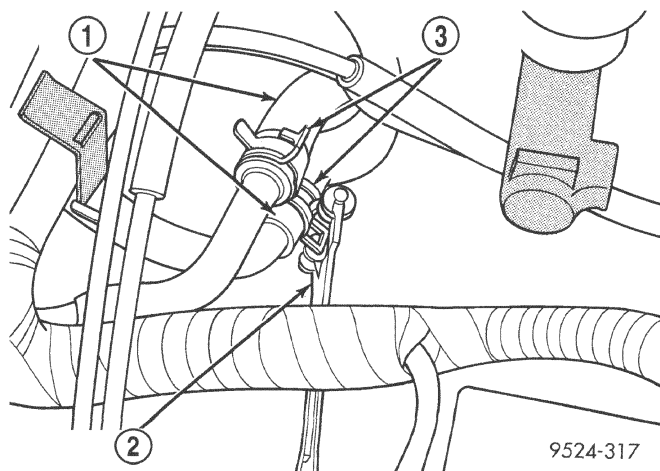
- (1) Drain engine cooling system. Refer to Group 7, Cooling System.
- (2) Using spring tension clamp pliers, remove clamps at each end of hose to be removed (Fig. 53) and (Fig. 54).
- (3) Carefully rotate hose back and forth while tugging slightly away from connector nipple.

**REMOVAL AND INSTALLATION (Continued)**

**CAUTION:** When removing hoses from heater core inlet or outlet nipples, do not use excessive force. Heater core may become damaged and leak engine coolant into heater unit.

**INSTALLATION**

For installation, reverse the above procedures.



**Fig. 53 Heater Hose Connection At Engine**

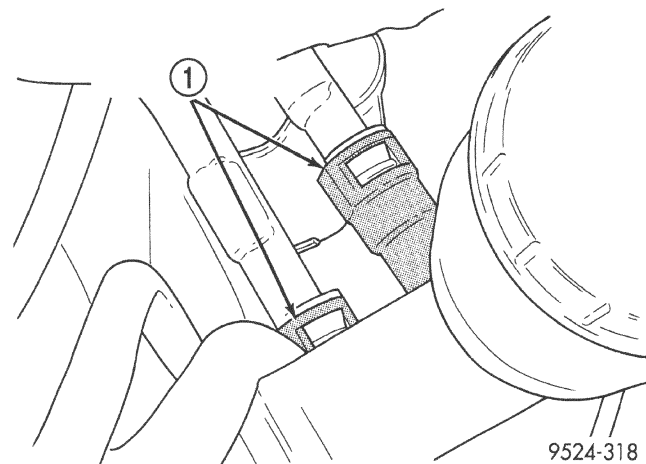
- 1 - HEATER HOSES
- 2 - SPRING TENSION CLAMP PLIERS
- 3 - HEATER HOSE CLAMPS

OEM parts. The hoses are attached at the heater core using spring tension clamps.

**NOTE:** Review Safety Precautions and Warnings before proceeding with this operation.

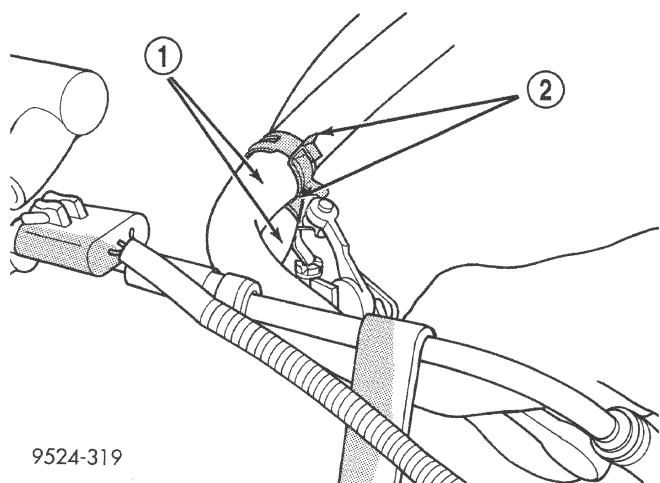
(1) Drain engine cooling system. Refer to Group 7, Engine Cooling.

(2) Using thin slide-jaw pliers, pinch quick connect fitting in, of hose to be removed (Fig. 55).



**Fig. 55 Heater Hose Connection At Engine**

- 1 - HEATER HOSE QUICK CONNECT FITTINGS



**Fig. 54 Heater Hose Connection At Heater Core**

- 1 - HEATER HOSES
- 2 - HEATER HOSE SPRING TENSION CLAMPS

(3) Remove intake manifold plenum. Refer to Group 11, Exhaust System And Intake Manifold for service information.

(4) Using spring tension clamp pliers, remove clamp at heater core end of hose to be removed (Fig. 54).

(5) Carefully rotate hose back and forth while tugging slightly away from connector nipple.

**CAUTION:** When removing hoses from heater core inlet or outlet nipples, do not use excessive force. Heater core may become damaged and leak engine coolant into heater unit.

**INSTALLATION**

For installation, reverse the above procedures.

**LIQUID LINE****TO EXPANSION VALVE****REMOVAL**

(1) Remove refrigerant from the A/C system using a refrigerant recovery machine.

(2) Remove A/C quick connect clip at expansion valve (Fig. 56).

**HEATER HOSES (2.5L)****REMOVAL**

The heater hoses for the 2.5L engine are preformed hoses with quick connect fittings at the engine. These hoses are not serviceable and must be replaced using



## REMOVAL AND INSTALLATION (Continued)

(3) Disconnect quick connector on expansion valve. Remove liquid line from expansion valve. Use Special Tool kit 7193 to disconnect quick connector (Fig. 57).

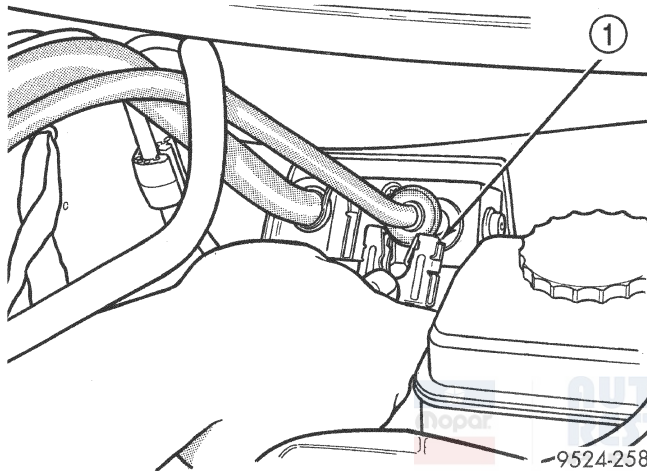
**CAUTION:** Cap all lines that are not being replaced and cap the expansion valve tubes.

(4) Disconnect liquid line from the receiver/drier (Fig. 58).

(5) Remove the liquid line from the vehicle.

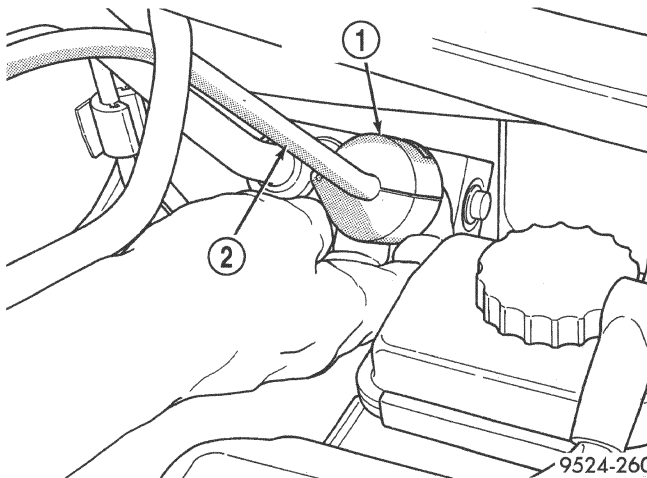
## INSTALLATION

For installation, reverse the above procedures.



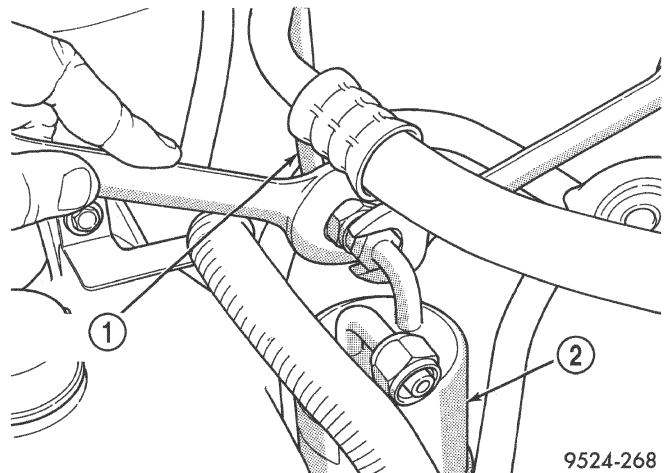
**Fig. 56 Liquid Line Clip At Expansion Valve**

1 - LIQUID LINE CLIP



**Fig. 57 Use Special Tool 7240 For Quick Connect**

1 - SPECIAL TOOL OTC 7240  
2 - LIQUID LINE



**Fig. 58 Liquid Line At Receiver/Drier**

1 - LIQUID LINE AT RECEIVER DRIER  
2 - RECEIVER DRIER

## TO CONDENSER

### REMOVAL

(1) Remove refrigerant from the A/C system using a refrigerant recovery machine.

(2) Remove A/C quick connect clip at condenser (Fig. 59).

(3) Disconnect quick connector at condenser. Remove liquid line from condenser. Use special tool kit 7193 to disconnect quick connector (Fig. 60). Remove line at condenser (Fig. 61).

**CAUTION:** Cap all lines that are not being replaced and cap the condenser inlet.

(4) Disconnect liquid line from the receiver/drier (Fig. 62).

(5) Remove the liquid line from the vehicle.

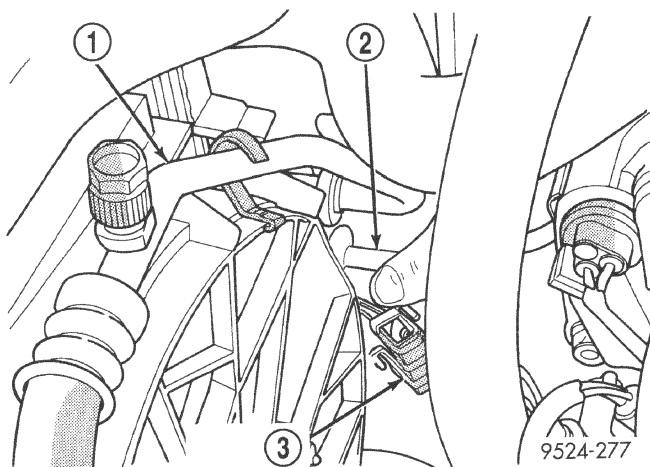
### INSTALLATION

For installation, reverse the above procedures.

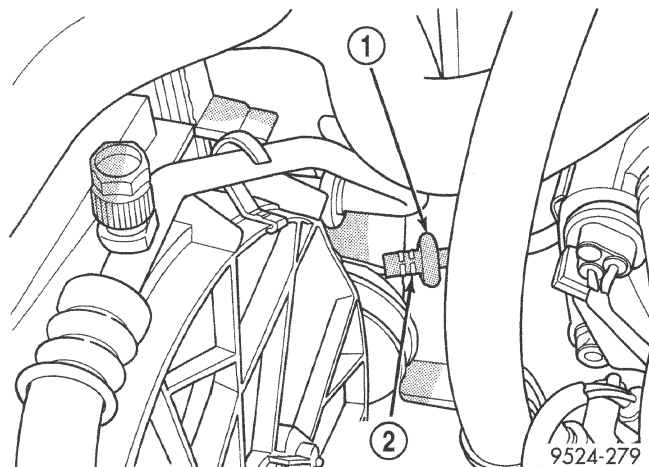
## MODE DOOR ACTUATOR MOTOR

**NOTE:** If battery voltage is low or not sensed at the actuator/motor for less than a (60) second interval, the actuator/motor will be out of calibration. Remove the M1 (I. O. D.) fuse for a minimum of (60) seconds. The actuator/motor will then self calibrate itself upon reinstallation of fuse.

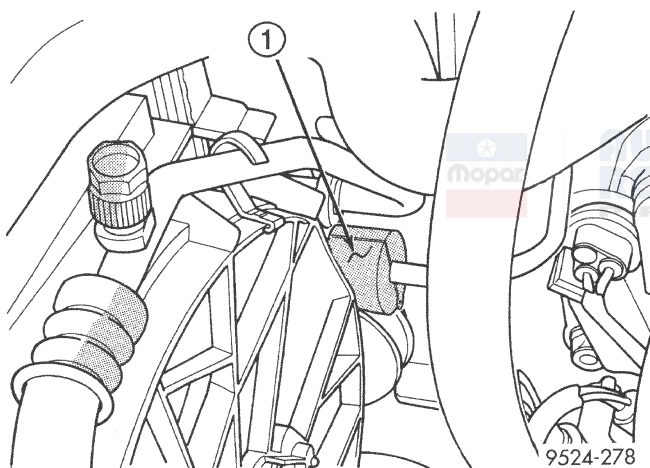


**REMOVAL AND INSTALLATION (Continued)****Fig. 59 Clip Removal**

- 1 - DISCHARGE LINE
- 2 - LIQUID LINE
- 3 - LIQUID LINE CLIP

**Fig. 61 Line At Condenser**

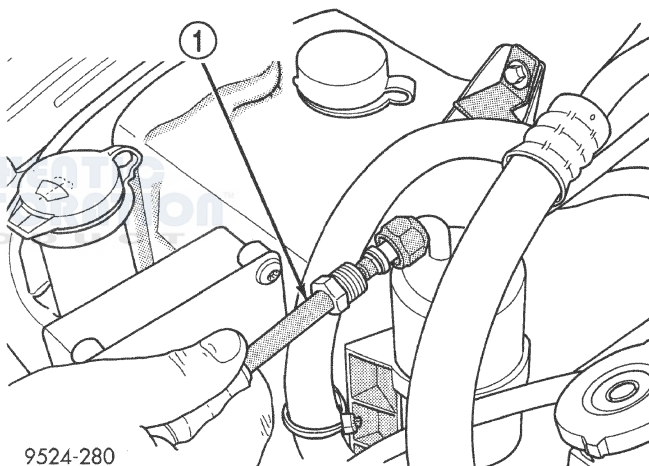
- 1 - LIQUID LINE
- 2 - DOUBLE O-RINGS

**Fig. 60 Quick Coupler Using Special Tool 7240**

- 1 - SPECIAL TOOL OTC 7240

The mode door actuator is an electric motor. It mechanically positions the A/C unit panel/bi-level door and the floor/defrost door. Prior to part replacement, re-calibration of the HVAC actuator is recommended. Calibration is performed by disconnecting the battery negative cable or the removal of the instrument panel M-1 fuse. Electrical power should be re-established after (60) seconds which will automatically initiate the software calibration procedure. If this procedure fails, it will be necessary to replace the mode door actuator/motor. The mode door actuator/motor is not serviceable and must be replaced if found to be defective.

The mode door actuator is located on the upper left side of the A/C- Heater housing (Fig. 63).

**Fig. 62 Liquid Line at Receiver/Drier**

- 1 - LIQUID LINE AT RECEIVER-DRIER

**REMOVAL**

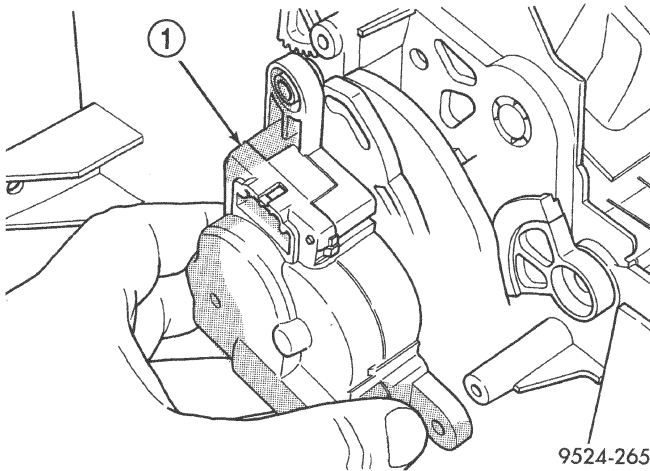
- (1) Disconnect battery negative cable.
- (2) Remove left underpanel silencer/duct.
- (3) Remove electrical connection on actuator (Fig. 64).
- (4) Remove actuator retaining screws. Then pull actuator straight down. Upon removal, note the shaft position of the actuator, because the shaft on this motor is keyed. When installing new actuator, its shaft must be positioned in the same location.

**INSTALLATION**

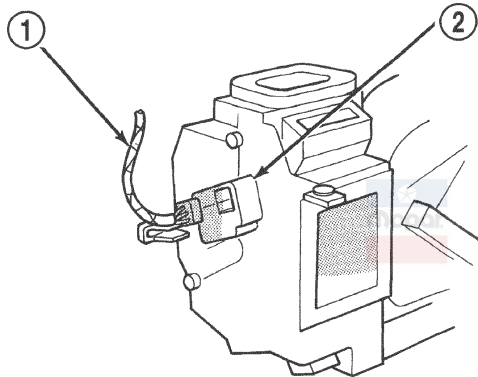
For installation, reverse the above procedures.

**RECIRCULATION DOOR CABLE**

The RECIRC door is actuated by a cable which mechanically positions the door.

**REMOVAL AND INSTALLATION (Continued)****Fig. 63 Mode Door Motor Location**

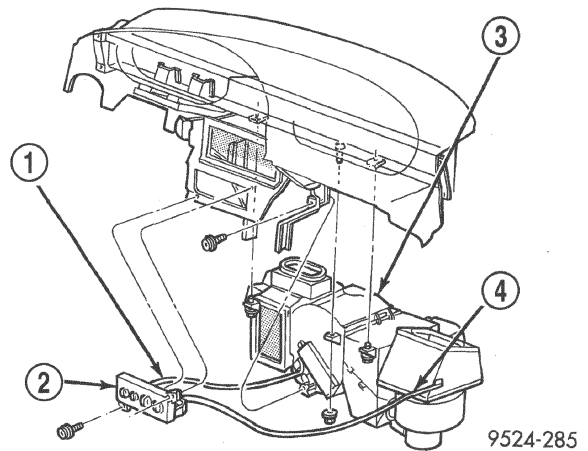
1 - MODE DOOR MOTOR

**Fig. 64 Mode Motor Connector**1 - CONNECTOR  
2 - MODE MOTOR

The RECIRC door actuator is located at the far right of the A/C Heater housing near the right A-pillar (Fig. 65).

**REMOVAL**

- (1) Place the ignition key in the OFF position before removing control module.
- (2) Remove trim bezel (Fig. 66).
- (3) Remove cluster hood bezel retaining screws in the trim bezel opening (Fig. 67).
- (4) Pry up the cluster hood bezel a few inches to expose the cubby bin/cigar lighter bezel screws.
- (5) Remove the cubby bin/cigar lighter bezel and wiring.
- (6) Remove the control module retaining screws.
- (7) Drop the A/C control module into the cigar lighter/cubby bin bezel opening (Fig. 68). Then disconnect the wiring on the rear of the control module.

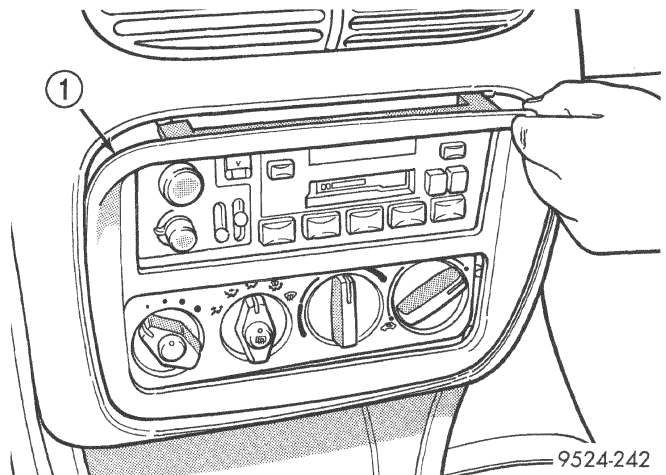
**Fig. 65 Recirculation Cable Location**1 - TEMPERATURE DOOR CABLE  
2 - CONTROL MODULE  
3 - A/C HOUSING  
4 - RECIRCULATION DOOR CABLE

(8) Release the recirculation cable retaining clip from the top of the control module. Retain the clip for future use. Then disconnect the recirculation control cable.

(9) Remove right under panel silencer/duct.

(10) Disconnect cable flag at right of recirculation housing (Fig. 69).

(11) Remove cable core end from recirculation actuator lever.

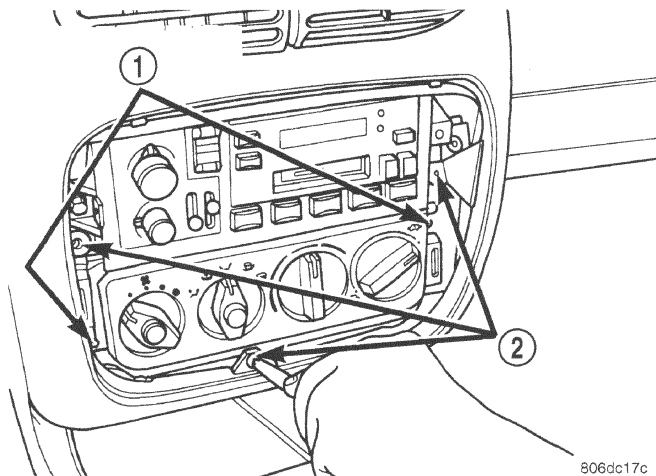
**Fig. 66 Trim Bezel**

1 - TRIM BEZEL

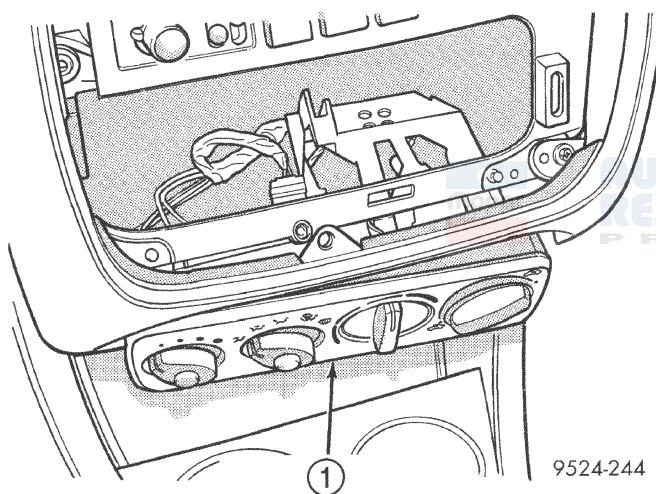
**INSTALLATION**

For installation, reverse the above procedures. Verify that the cables are properly adjusted, free of interference, and the module is seated properly.



**REMOVAL AND INSTALLATION (Continued)****Fig. 67 Control Module Screws**

- 1 - CONTROL MODULE SCREWS  
2 - CLUSTER HOOD SCREWS

**Fig. 68 Control Module At Bezel Opening**

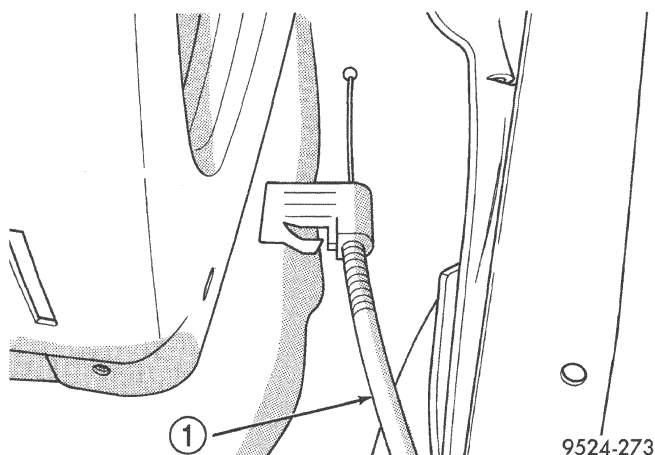
- 1 - CONTROL MODULE

**CABLE ADJUSTMENT**

The cables must be adjusted for proper function of the control module. To adjust the cable, attach the cable to the lever arm of the control module. Turn the knob fully counterclockwise. Pull the cable jacket away from the cable end until taut. Clip the cable jacket to the control module. The knob should travel a full 180° if the cable is properly adjusted.

**SUCTION LINE****REMOVAL**

- (1) Remove refrigerant from the A/C system using a refrigerant recovery machine.
- (2) Remove suction line clip at right strut tower (Fig. 70).

**Fig. 69 Disconnect Recirculation Cable**

- 1 - RECIRCULATION CABLE

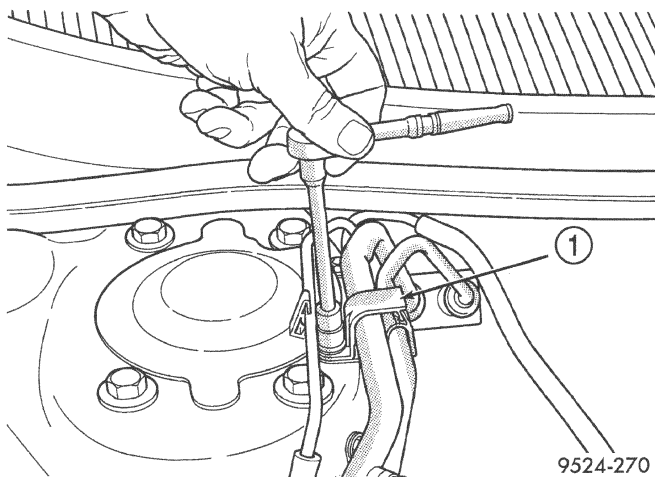
(3) Remove quick connect clip (Fig. 71). Disconnect quick connect at expansion valve end using Special Tool Kit 7193.

**CAUTION: Cap all lines that are not being replaced and cap the expansion valve tubes.**

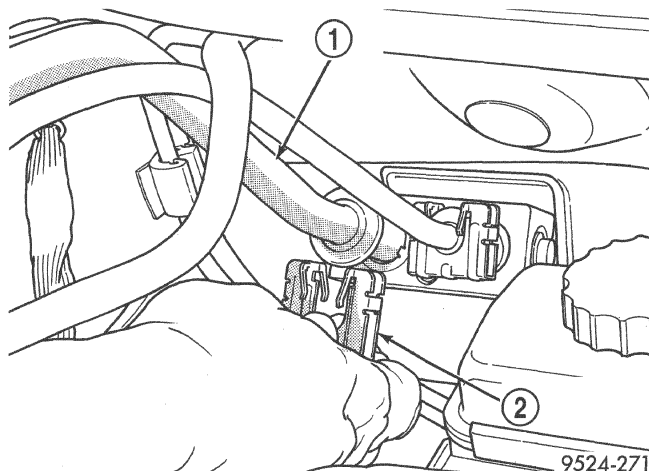
- (4) Disconnect line at compressor end (Fig. 72).
- (5) Remove suction line from vehicle.

**INSTALLATION**

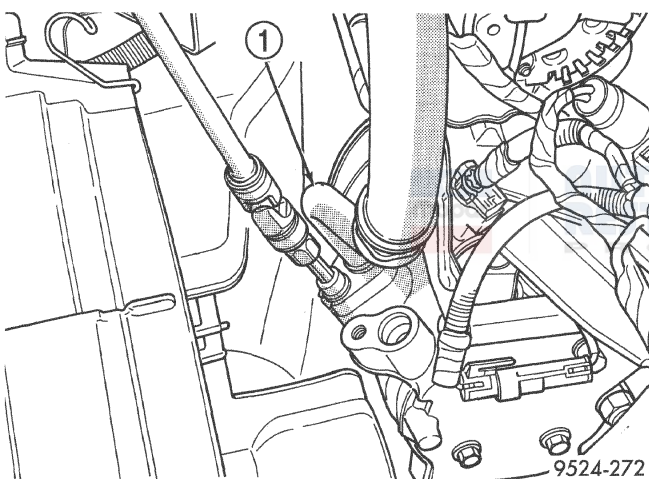
For installation, reverse the above procedures. Tighten bolts to 22 N·m (200 in. lbs.).

**Fig. 70 Suction Line Routing Clip**

- 1 - A/C LINES CLIP

**REMOVAL AND INSTALLATION (Continued)****Fig. 71 Quick Connect Clip**

- 1 - SUCTION LINE  
2 - SUCTION LINE CLIP

**Fig. 72 Suction Line At Compressor**

- 1 - SUCTION LINE

**TEMPERATURE DOOR CABLE**

The blend-air (temperature) door is actuated by a cable which mechanically positions the temperature door.

The temperature door actuator is located at the center of the A/C Heater housing at the center tunnel.

**REMOVAL**

- (1) Place the ignition key in the OFF position before removing control module.
- (2) Remove trim bezel (Fig. 66).
- (3) Remove cluster hood bezel retaining screws in the trim bezel opening (Fig. 67).
- (4) Pry up the cluster hood bezel a few inches to expose the cubby bin/cigar lighter bezel screws.

(5) Remove the cubby bin/cigar lighter bezel and wiring.

(6) Remove the control module retaining screws.

(7) Remove control module and disconnect the wire connectors.

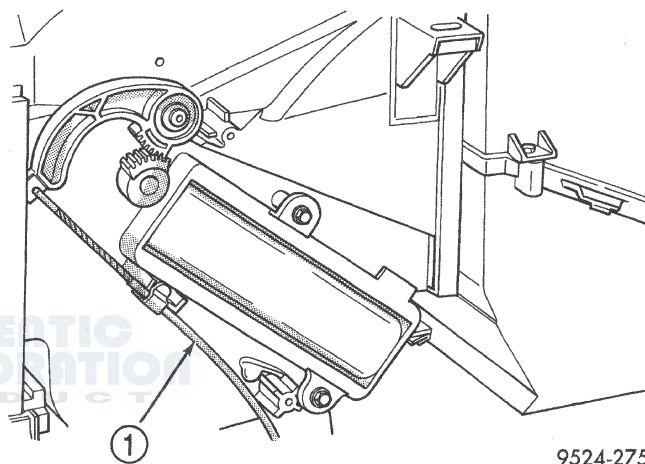
(8) Release the temperature control cable retaining clip from the top of the control module. Retain the clip for future use. Then disconnect the temperature control cable.

(9) Disconnect cable at A/C housing (Fig. 73).

(10) Remove cable core end from temperature actuator lever.

**INSTALLATION**

For installation, reverse the above procedures.

**Fig. 73 Temperature Cable At A/C Housing**

- 1 - TEMPERATURE CABLE

**THERMAL LIMITER SWITCH**

There is no serviceability of the thermal limiter switch. If the thermal limiter switch fails, the compressor must be replaced. To replace the compressor, refer to Compressor Replacement in this section.

**UNIT HOUSING****REMOVAL**

The heater core may be removed without removing the unit housing. Refer to heater core replacement in this section.

- (1) Disconnect battery negative remote cable. This must be done to prevent accidental air bag deployment.



**REMOVAL AND INSTALLATION (Continued)**

**WARNING: AVOID BREATHING A/C REFRIGERANT AND LUBRICANT VAPOR OR MIST. EXPOSURE MAY IRRITATE EYES, NOSE AND THROAT. USE ONLY APPROVED SERVICE EQUIPMENT MEETING SAE REQUIREMENTS TO DISCHARGE R-134a SYSTEM. IF ACCIDENTAL SYSTEM DISCHARGE OCCURS, VENTILATE WORK AREA BEFORE RESUMING SERVICE.**

**R-134a SERVICE EQUIPMENT OR VEHICLE A/C SYSTEM SHOULD NOT BE PRESSURE TESTED OR LEAK TESTED WITH COMPRESSED AIR. SOME MIXTURES OF AIR/R-134a HAVE BEEN SHOWN TO BE COMBUSTIBLE AT ELEVATED PRESSURES. THESE MIXTURES ARE POTENTIALLY DANGEROUS AND MAY RESULT IN FIRE OR EXPLOSION CAUSING INJURY OR PROPERTY DAMAGE.**

(2) Using an A/C recovery unit, remove all R-134a refrigerant from the A/C system.

(3) Remove air cleaner hose and air distribution duct from the engine.

(4) Drain the engine cooling system.

**NOTE: If equipped with 2.5L engine, the upper intake manifold has to be removed at this time to access the heater hose connections at the bulkhead. Refer to group 11, Exhaust System And Intake Manifold for service information.**

(5) Disconnect heater hoses at the dash panel. Plug the heater core inlet and outlet tubes to prevent antifreeze from spilling on the vehicle interior during removal. If an appropriate plug cannot be found pull back carpet and use caution when removing unit. Keep the heater tubes elevated to prevent spillage of coolant.

(6) Remove both A/C lines from expansion valve. Use Special Tool Kit 7193 to disconnect quick connectors on A/C lines. Refer to A/C line removal in this section for complete procedure. After removing lines cap the expansion valve openings and the A/C hose openings. This will prevent any dirt or moisture from entering the refrigerant system during servicing.

**CAUTION: The lubricant used in this air conditioning system absorbs moisture readily (similar to brake fluid). Do not leave any portion of the system open for extended periods of time.**

(7) Remove trim bezel (Fig. 66).

(8) Remove cluster hood bezel retaining screws in the trim bezel opening (Fig. 67).

(9) Pry up the cluster hood bezel a few inches to expose the cubby bin/cigar lighter bezel screws.

(10) Remove the cubby bin/cigar lighter bezel and wiring.

(11) Remove the control module retaining screws.

(12) Drop the A/C control module into the cigar lighter/cubby bin bezel opening (Fig. 68). Then disconnect the wiring on the rear of the control module.

(13) Release the cable clips from the top of the control module. Retain the clips for future use. Then disconnect the temperature control and recirculation control cables.

(14) Remove the control module.

(15) Remove upper instrument panel bezel.

(16) Remove right and left instrument panel end caps.

(17) Remove left lower knee bolster. Disconnect mode door motor wiring.

(18) Remove right and left interior door post kick panel.

(19) Remove front and rear halves of floor console.

(20) Remove the radio.

(21) Remove right side lower silencer/duct.

(22) Remove glove box assembly.

(23) Remove right side vertical support strut brace.

(24) Remove left side vertical support strut brace.

(25) Remove center lower distribution housing.

(26) Remove bolts securing Heater-A/C housing to metal I/P frame.

(27) Remove upper instrument panel cowl trim cover.

(28) Disconnect steering column from instrument panel. Lower steering column.

(29) Remove instrument panel bolts at cowl fence.

(30) Remove bolts at lower A-posts.

(31) Remove instrument panel frame and wiring.

(32) Remove bolts securing Heater-A/C housing to cowl.

**INSTALLATION**

For installation, reverse the above procedure. Verify that the cables are properly adjusted, free of interference, and the control module is seated properly.

**CABLE ADJUSTMENT**

The cables must be adjusted for proper function of the control module. To adjust the cable, attach the cable to the lever arm of the control module. Turn the knob fully counterclockwise. Pull the cable jacket away from the cable end until taut. Clip the cable jacket to the control module. The knob should travel a full 180° if the cable is properly adjusted.

## DISASSEMBLY AND ASSEMBLY

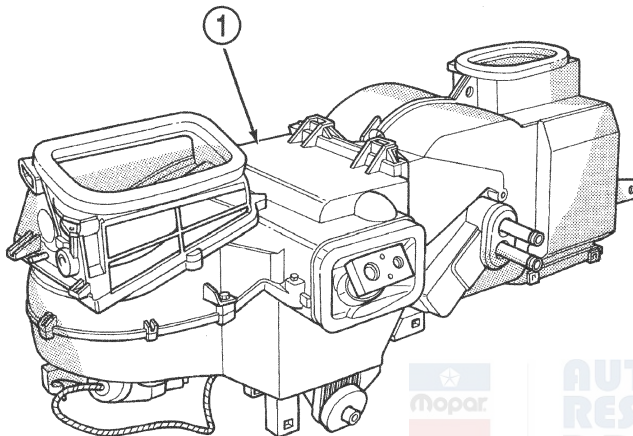
### UNIT HOUSING RECONDITION

Heater-A/C housing must be removed from vehicle before performing this operation. Refer to Heater-A/C Unit Housing—Removal and Installation.

The heater a/c unit need not be disassembled to replace the heater core. Refer to Heater Core replacement in this section.

### DISASSEMBLE

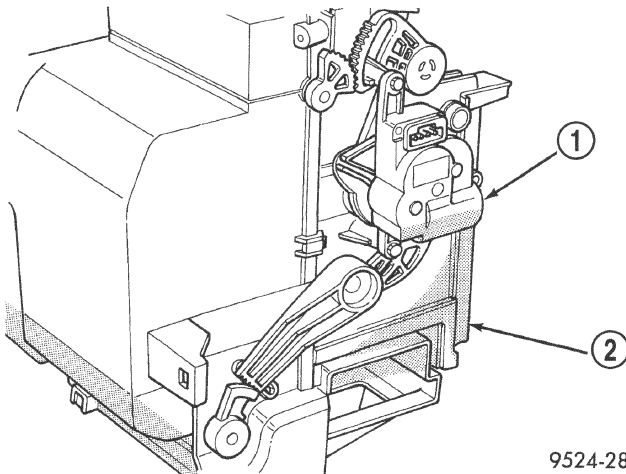
(1) Place Heater-A/C unit assembly on workbench (Fig. 74) and (Fig. 75).



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**Fig. 74 Heater-A/C Unit**

1 - HVAC UNIT

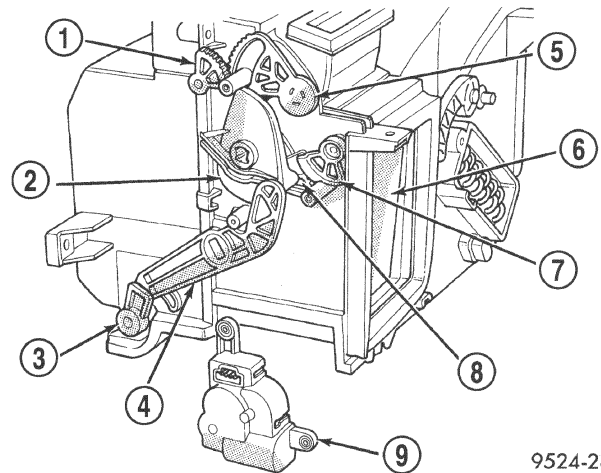


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**Fig. 75 Mode Motor Linkage**

1 - MODE MOTOR  
2 - HVAC UNIT

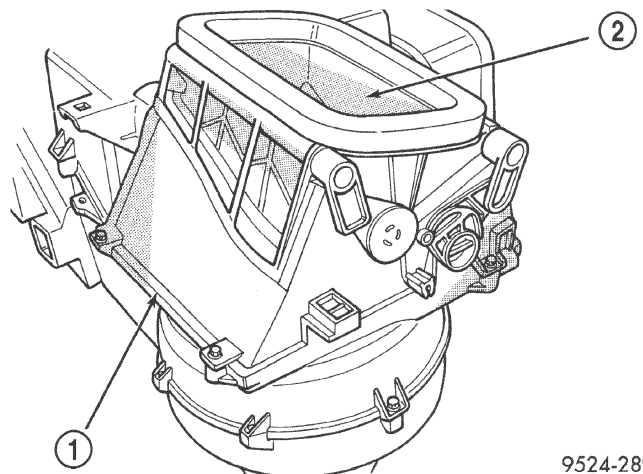
(2) Remove A/C mode motor (Fig. 76).  
(3) Remove upper recirculation air inlet housing (Fig. 77) and (Fig. 78).



9524-288

**Fig. 76 Mode Motor**

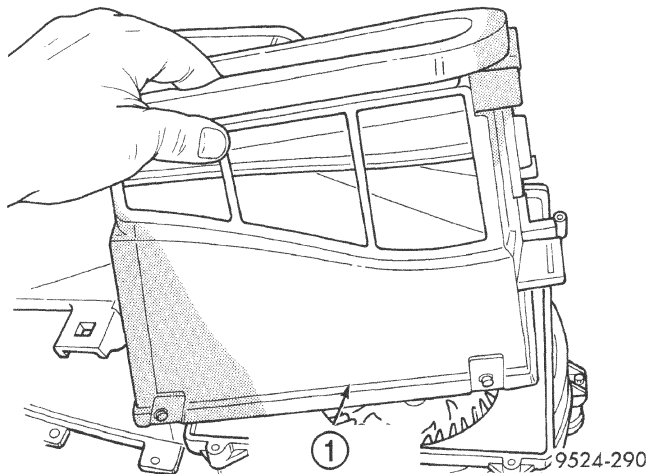
1 - DEFROST DOOR LEVER  
2 - MODE CAM  
3 - FLOOR DOOR LEVER  
4 - FLOOR DOOR LEVER LINK  
5 - DEFROST DOOR LINK LEVER  
6 - PANEL DOOR  
7 - PANEL DOOR LEVER  
8 - PANEL DOOR LEVER LINK  
9 - MODE MOTOR



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**Fig. 77 Recirculation Air Inlet**

1 - RECIRCULATION HOUSING  
2 - AIR INLET

**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 78 Recirculation Housing Removal**

1 - RECIRCULATION HOUSING

(4) From inside of air inlet, depress release tang on rear inlet door (Fig. 79).

(5) Remove rear Y-cam actuator lever (Fig. 80).

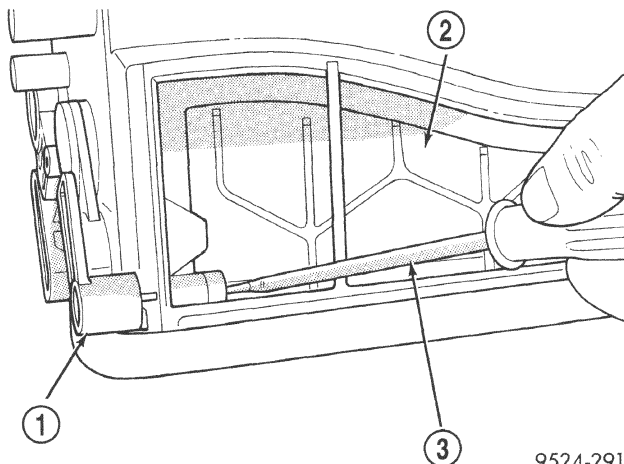
(6) Turn front toggle lever until it lines up with slots on housing.

(7) Pull straight up on toggle lever and slide toggle lever from underneath front actuator lever (Fig. 80).

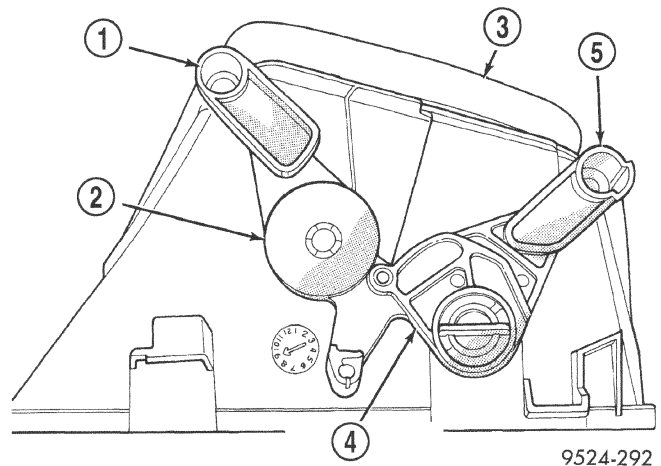
(8) Remove front toggle lever (Fig. 80).

(9) Remove Y-cam rear lever (Fig. 80).

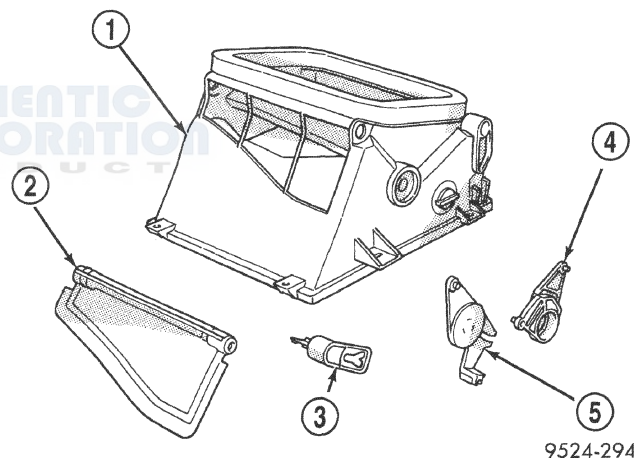
(10) Unsnap and remove rear air inlet door (Fig. 81).

**Fig. 79 Rear Y-Cam Release**

1 - Y-CAM ACTUATOR LEVER  
2 - REAR DOOR  
3 - FLAT BLADE PRY TOOL

**Fig. 80 Rear Y-Cam Actuator**

1 - REAR Y-CAM ACTUATOR LEVER  
2 - REAR LEVER  
3 - AIR INLET  
4 - FRONT TOGGLE LEVER  
5 - FRONT ACTUATOR LEVER

**Fig. 81 Rear Air Inlet Door**

1 - RECIRC HOUSING  
2 - REAR DOOR  
3 - REAR Y-CAM ACTUATOR LEVER  
4 - FRONT TOGGLE LEVER  
5 - REAR LEVER

(11) Front air inlet door and lever is serviced with recirculation housing.

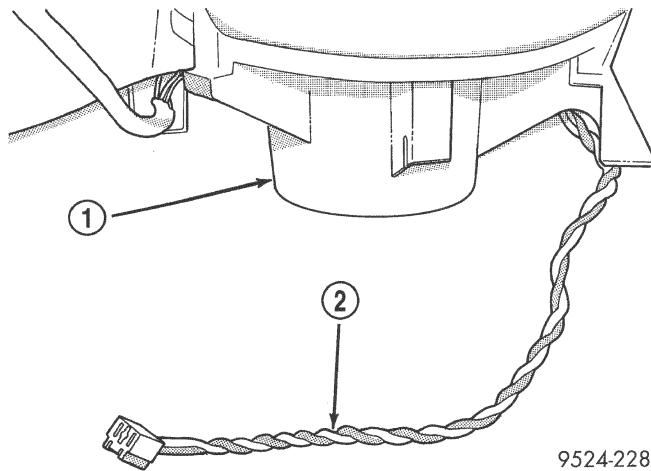
(12) Remove blower motor wiring at resistor (Fig. 82).

(13) Remove blower motor (Fig. 83).

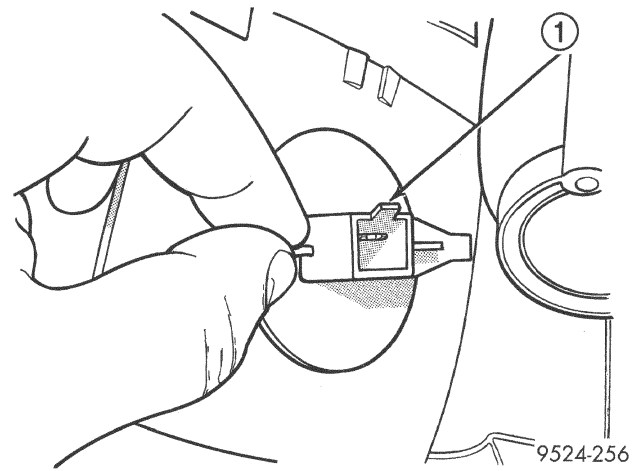
(14) Using a flat blade pry tool, Pull up on tab at evaporator probe cover (Fig. 84). Turn evaporator probe cover clockwise 90°.

(15) Remove evaporator probe cover. Pull evaporator needle from evaporator (Fig. 85).

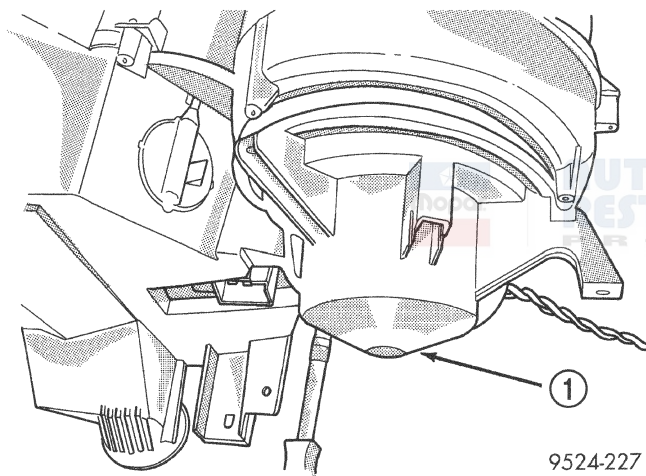


**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 82 Blower Motor Wiring**

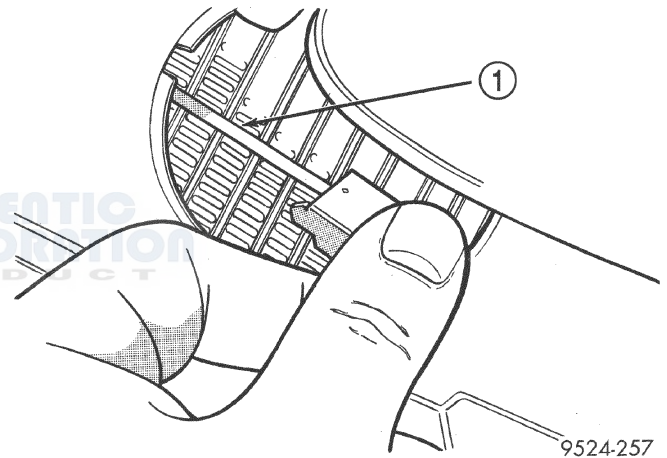
- 1 - BLOWER MOTOR  
2 - BLOWER MOTOR WIRING

**Fig. 84 Evaporator Probe**

- 1 - EVAPORATOR PROBE

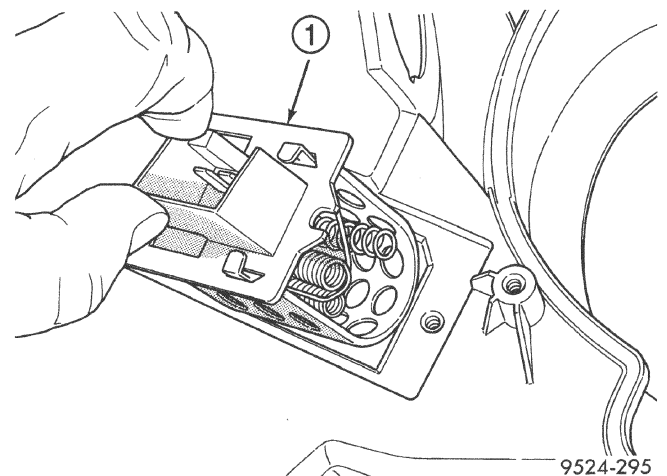
**Fig. 83 Blower Motor**

- 1 - BLOWER MOTOR

**Fig. 85 Evaporator Probe Needle**

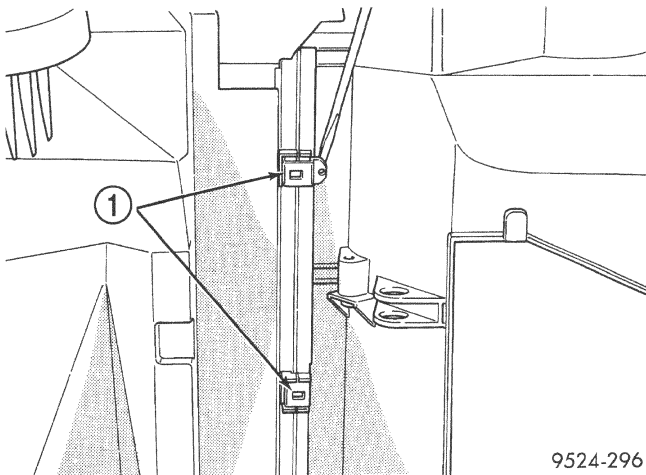
- 1 - EVAPORATOR PROBE NEEDLE

- (16) Remove blower motor resistor (Fig. 86).
- (17) Remove clips retaining evaporator housing to heater/distribution housing (Fig. 87).
- (18) Separate evaporator housing from heater/distribution housing (Fig. 88).
- (19) Remove seal around evaporator tube inlet (Fig. 89).
- (20) Remove evaporator housing upper cover (Fig. 90).
- (21) Lift evaporator out of lower housing (Fig. 91).

**Fig. 86 Blower Motor Resistor**

- 1 - BLOWER RESISTOR

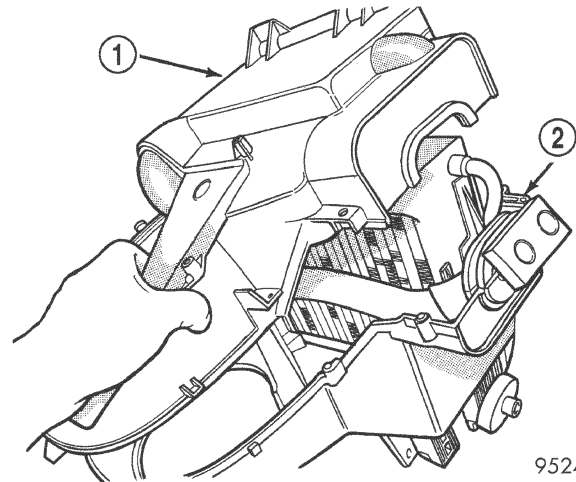


**DISASSEMBLY AND ASSEMBLY (Continued)**

9524-296

**Fig. 87 Housing Clips**

1 - MOUNTING CLIPS

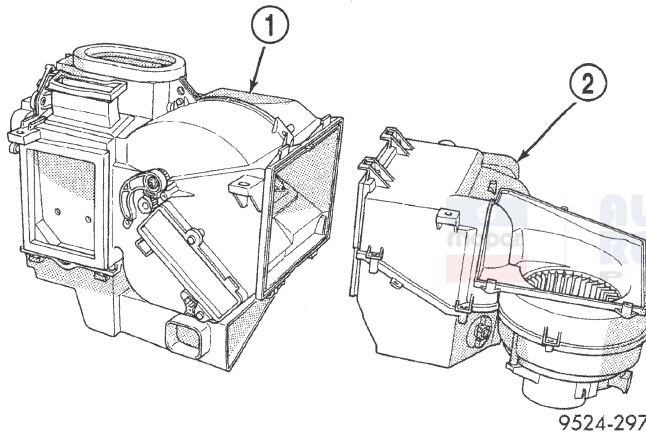


9524-253

**Fig. 90 Evaporator Housing Upper Cover**

1 - EVAPORATOR HOUSING COVER

2 - EVAPORATOR HOUSING

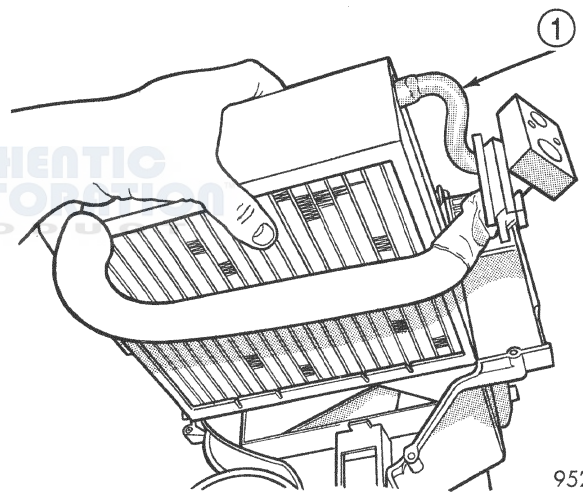


9524-297

**Fig. 88 Separate Housings**

1 - HEATER DISTRIBUTION HOUSING

2 - A/C EVAPORATOR HOUSING



9524-254

**Fig. 91 Remove Evaporator From Housing**

1 - EVAPORATOR



9524-298

**Fig. 89 Evaporator Tube Inlet Seal**

1 - EVAPORATOR CORE SEAL

(22) Remove styrofoam seal around evaporator.

(23) Remove lower heat/distribution housing clips. Remove housing (Fig. 92).

(24) Remove heater core cover (Fig. 93) and (Fig. 94).

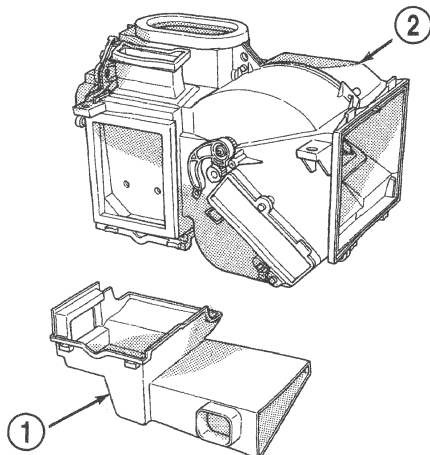
(25) Slide heater core out of heater housing (Fig. 95).

(26) Remove temperature door lever link retaining screw (Fig. 96).

(27) Remove temperature door lever link (Fig. 97).

(28) From the panel door air opening, using a long thin screwdriver, push in clip for floor door gear. Remove floor door gear (Fig. 98).

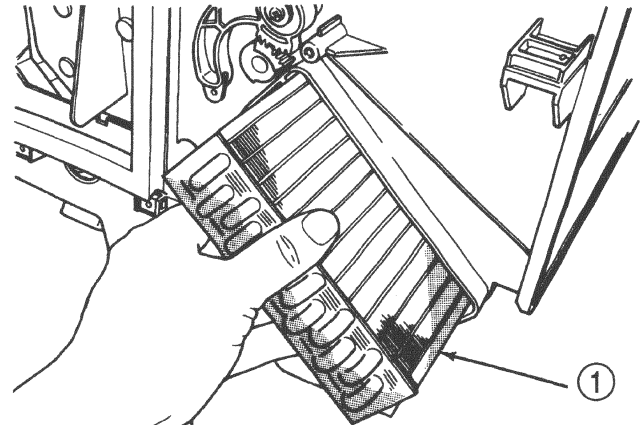
(29) Turn floor door lever link until it aligns with slots cut into it (Fig. 99). Remove floor door lever link (Fig. 100).

**DISASSEMBLY AND ASSEMBLY (Continued)**

9524-299

**Fig. 92 Lower Floor Distribution Housing**

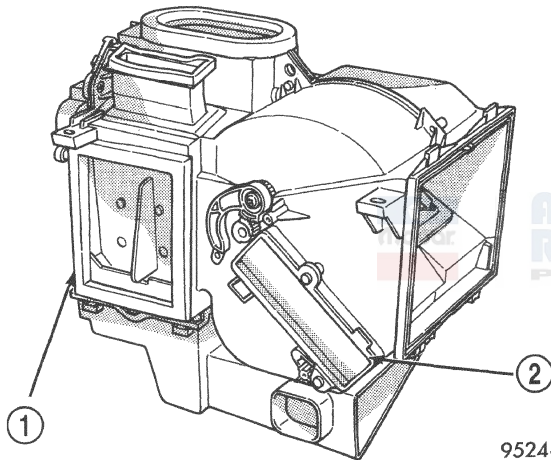
- 1 - FLOOR DISTRIBUTION HOUSING  
2 - HEATER DISTRIBUTION HOUSING



9524-302

**Fig. 95 Slide Out Core**

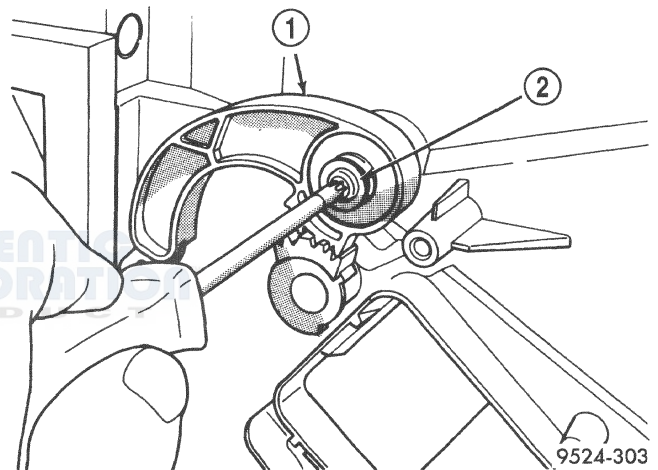
- 1 - HEATER CORE



9524-300

**Fig. 93 Heater Core Cover**

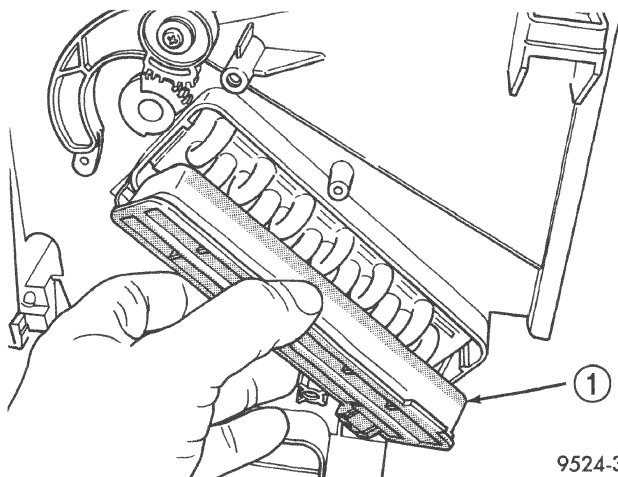
- 1 - HEATER DISTRIBUTION HOUSING  
2 - HEATER CORE COVER



9524-303

**Fig. 96 Temperature Door Lever Link**

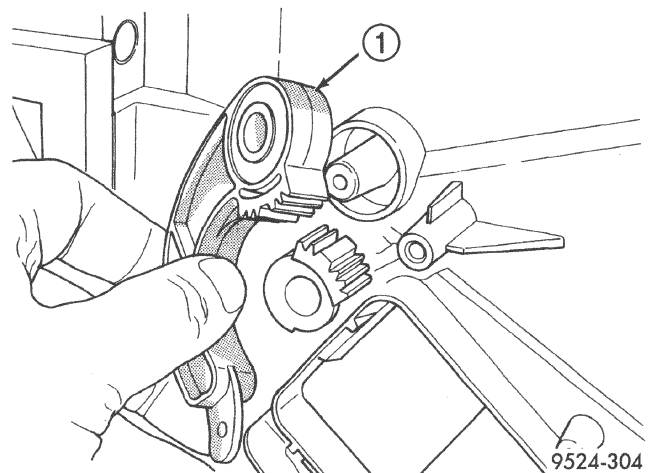
- 1 - TEMPERATURE DOOR LEVER LINK  
2 - MOUNTING SCREW



9524-301

**Fig. 94 Heater Core Cover Removal**

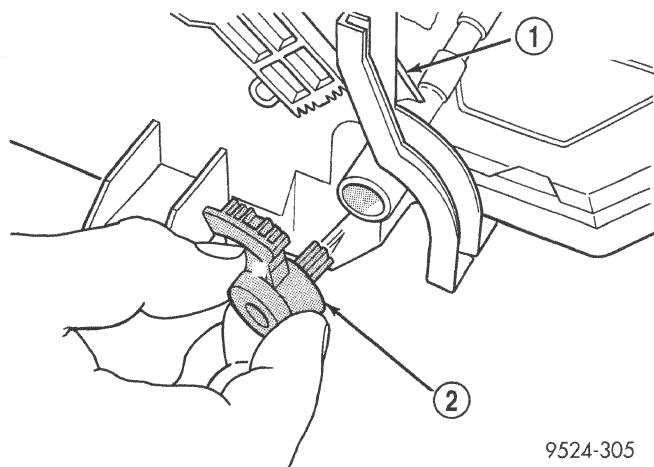
- 1 - HEATER CORE COVER



9524-304

**Fig. 97 Temperature Door Lever Link Removal**

- 1 - TEMPERATURE DOOR LEVER LINK

**DISASSEMBLY AND ASSEMBLY (Continued)**

9524-305

**Fig. 98 Floor Door Gear**

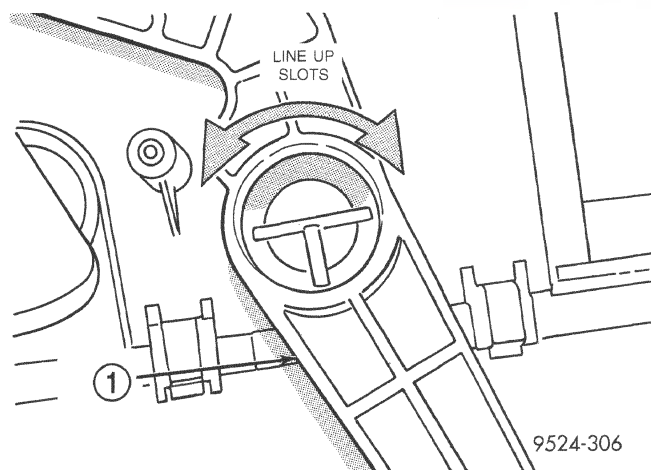
- 1 - FLAT BLADE PRY TOOL  
2 - FLOOR DOOR GEAR

(30) Remove mode motor cam from housing (Fig. 101) and (Fig. 102).

(31) From panel door access, using a long thin screwdriver, push in release tang on panel door gear (Fig. 103).

(32) Remove panel door gear from housing.

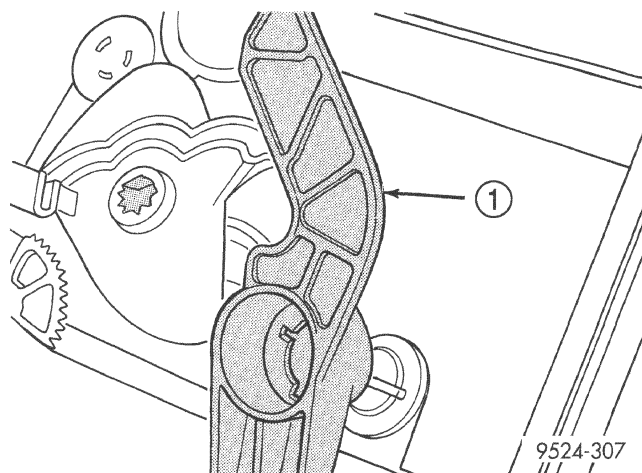
(33) Line up slots on panel door lever link. Remove panel door lever link from housing (Fig. 104).



9524-306

**Fig. 99 Align Slots**

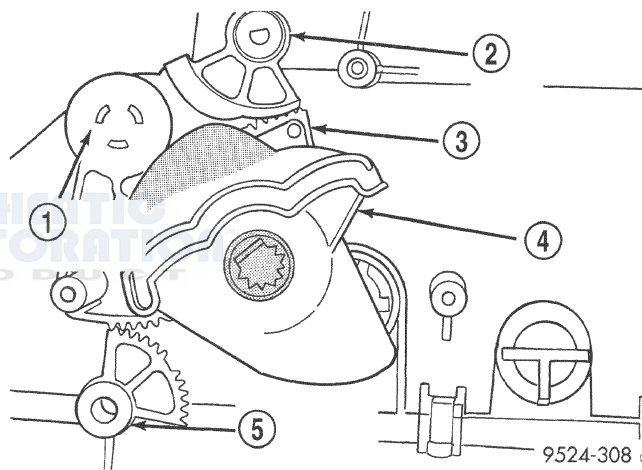
- 1 - FLOOR DOOR LEVER LINK



9524-307

**Fig. 100 Remove Lever Link**

- 1 - FLOOR DOOR LEVER

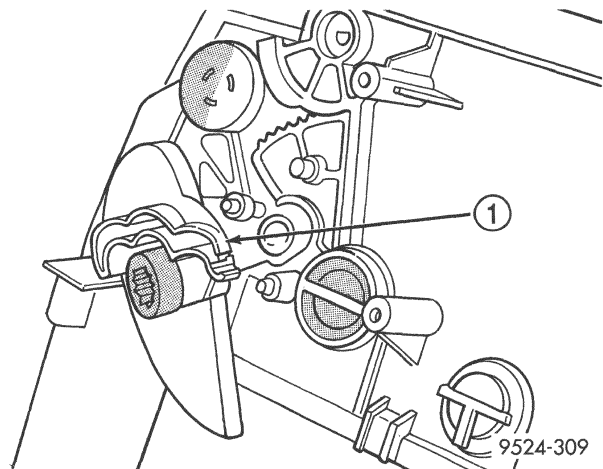


9524-308

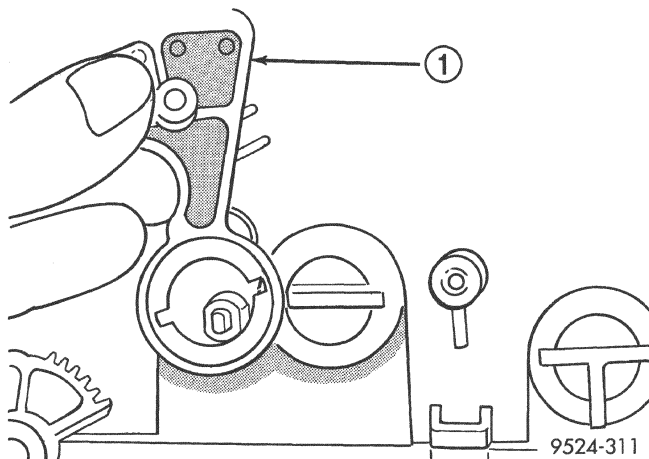
**Fig. 101 Mode Motor Cam**

- 1 - DEFROST DOOR LEVER LINK  
2 - PANEL DOOR LEVER  
3 - PANEL DOOR LEVER LINK  
4 - MODE CAM  
5 - DEFROST DOOR LEVER

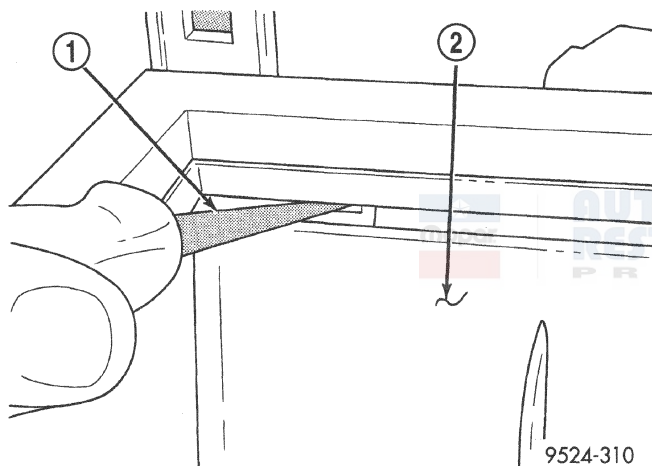
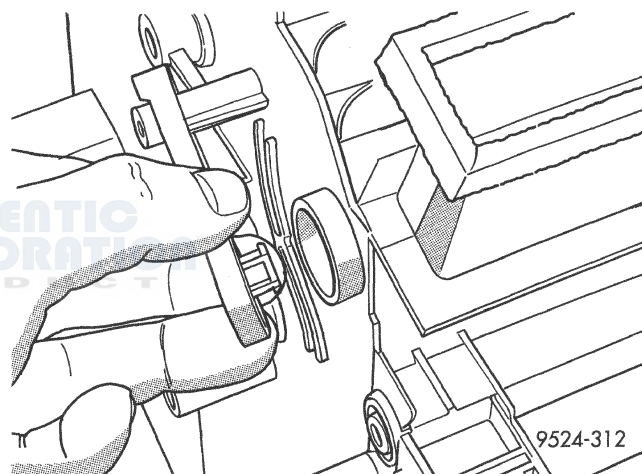


**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 102 Mode Motor Cam Removal**

1 - MODE CAM

**Fig. 104 Panel Door Lever Link**

1 - PANEL DOOR LEVER LINK

**Fig. 103 Panel Door Gear Release**1 - FLAT BLADE PRY TOOL  
2 - PANEL DOOR**Fig. 105 Defrost Door Lever Link**

(34) Unsnap defrost door lever link from housing (Fig. 105).

(35) Remove defrost door seal from housing.

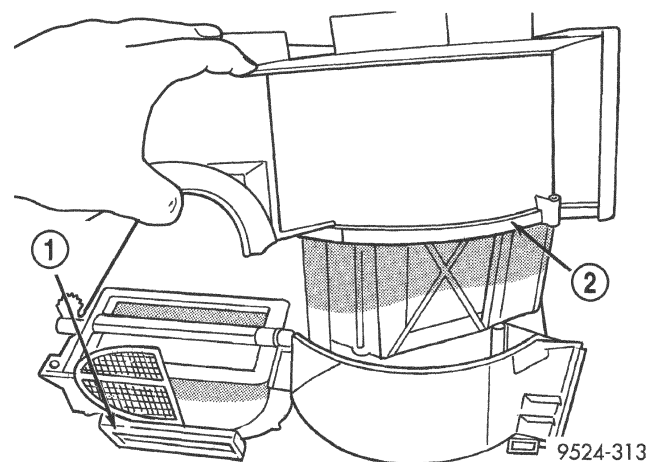
(36) Remove A/C housing rear cover half from front half (Fig. 106).

(37) Remove defrost door from housing (Fig. 107).

(38) Depress retaining clip at temperature control door, remove temperature control door (Fig. 108).

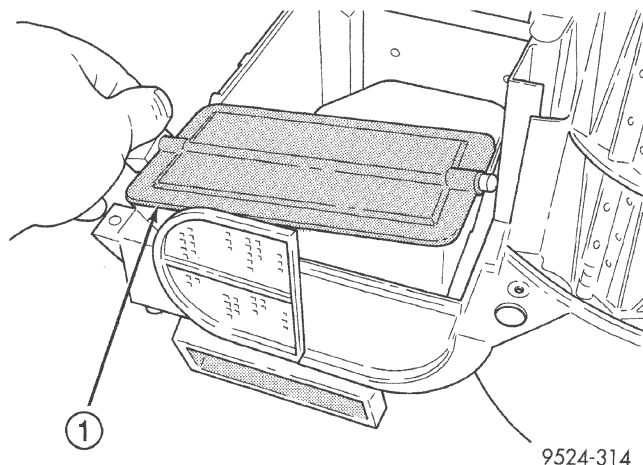
(39) Unsnap panel door from rear half of housing. Remove door from housing.

(40) Unsnap floor door from front half of housing. Remove door from housing (Fig. 109).

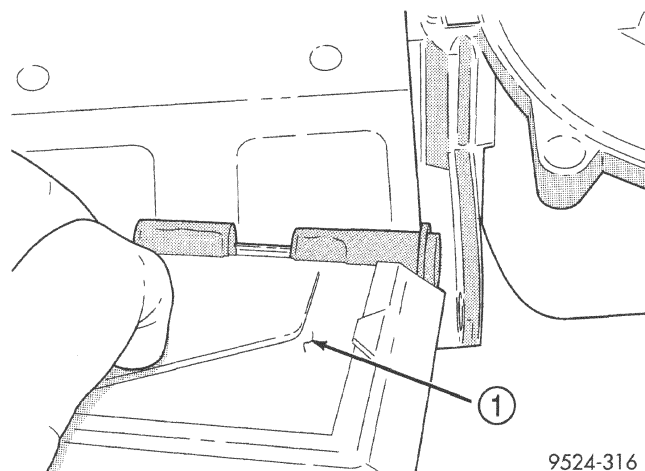
**Fig. 106 Front And Rear Housing Halves**1 - REAR COVER  
2 - FRONT COVER**ASSEMBLE**

(1) Install floor, panel, temperature, and defrost doors in housings.

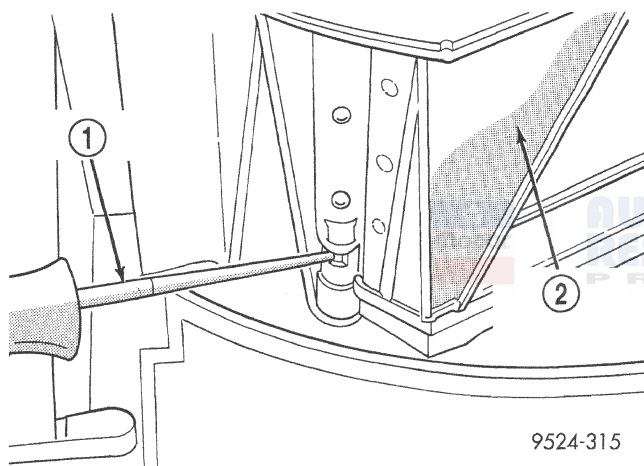


**DISASSEMBLY AND ASSEMBLY (Continued)****Fig. 107 Defrost Door Removal**

1 - DEFROST DOOR

**Fig. 109 Floor Door Removal**

1 - FLOOR DOOR

**Fig. 108 Temperature Control Door Removal**

1 - FLAT BLADE PRY TOOL

2 - TEMPERATURE CONTROL DOOR

- (2) Position front A/C housing half to rear half. Install retaining screws.
- (3) Install defrost door seal.
- (4) Snap defrost door lever link to door.
- (5) Install panel door lever link. Install panel door lever gear.
- (6) Install mode motor cam.
- (7) Install floor door lever link.
- (8) Install floor door lever gear.
- (9) Install temperature door lever gear.
- (10) Install temperature door lever link.
- (11) Slide heater core into housing. Install cover.
- (12) Install lower distribution housing and clips.
- (13) Install styrofoam to evaporator. Install evaporator into the evaporator housing.
- (14) Install upper cover to evaporator housing.
- (15) Install seal around evaporator tube inlet.

(16) Install evaporator probe into evaporator and housing.

(17) Install blower motor and resistor.

(18) Install air inlet housing to evaporator housing.

(19) Install evaporator housing to heat/distribution housing.

(20) Install mode motor.

**SPECIFICATIONS****A/C APPLICATION TABLE****COMPRESSOR****DESCRIPTION**

Displacement per Revolution . . . 85.7 cc/rev (5.2 cu. in./rev.)

Maximum Allowable rpm . . . . . 12000 rpm

Maximum Allowable Continuous rpm . . 10000 rpm

Refrigerant . . . . . R-134A

Oil . . . . . SP15PAG 150cc (5.08 fl. oz.)

Weight . . . . . 39.2 N·m (8.82 lbs., 4.0 kgf.)

**CLUTCH****DESCRIPTION**

Rated Voltage . . . . . 12 VDC

Minimum Breakaway Torque . . . . . 31.4 N·m  
(23 ft. lbs., 3.2 Kgf.m) at 12VDC

Minimum Engagement Voltage . . . 7.5 AT AIR GAP  
0.5 mm REF

Power Consumption . . . . . 50 WATTS MAX.

Pulley Diameter . . . . . 110 mm DIA. (4.3 in.)

Weight . . . . . 18.9 N·m (4.23 lbs., 1.92 Kgf.)

Clutch Type . . . . . Standard

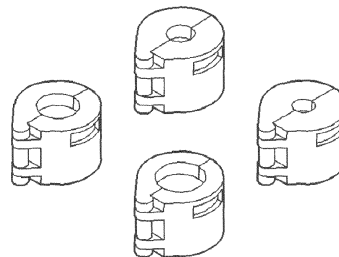
**SPECIFICATIONS (Continued)**

Item	Description	Notes
VEHICLE	Sebring Convertible	2-door convertible
SYSTEM	R134a w/expansion valve	
COMPRESSOR	Sanden TRS-090 (Scroll)	SP-15 PAG Oil
Freeze-up Control	evaporator temp probe (2-wire)	BCM input, signals OFF < 33.7° F, ON > 35.7° F
Low psi Control	pressure transducer to PCM	opens < 29.4 psi
High psi Control		opens > 431 psi
Thermal Limiter Switch	cut Out > 252-262° F, cut In < 225-235° F	scroll compressors only serviced with clutch
CONTROL HEAD	manual type	resistive multiplex signal for A/C request to BCM
Mode Door	electric actuator w/feedback	BCM controlled
Blend Air Door	cable	
Fresh/Recirc door	cable	
Blower Motor	hardwired to control head	resistor block
COOLING FANS	PCM controlled module, two fan motors - low/high	low & high relays
CLUTCH		
Control	relay	PCM
Draw	2-4.15 amps @ 12V	± 0.5V
Gap	0.013"-0.025"	
DRB III®		
Reads	Mode door, TPS, RPM, A/C switch test	
Actuators	clutch and fan relays	

**THERMAL LIMITER SWITCH****DESCRIPTION****TEMPERATURE**

Cut OFF Temperature . . . 122 to 128°C (252 to 262°F)

Cut IN Temperature . . . . 104 to 116°C (225 to 235°F)

**SPECIAL TOOLS****AIR CONDITIONING****A/C Line Disconnect Tool 7193**

# EMISSION CONTROL SYSTEMS

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## ON-BOARD DIAGNOSTICS

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## DESCRIPTION AND OPERATION

### SYSTEM DESCRIPTION

#### OPERATION

The Powertrain Control Module (PCM) monitors many different circuits in the fuel injection, ignition, emission and engine systems. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the PCM's memory. If the code applies to a non-emissions related component or system, and the problem is repaired or ceases to exist, the PCM cancels the code after 40 warmup cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator Lamp (MIL). Refer to Malfunction Indicator Lamp in this section.

Certain criteria must be met before the PCM stores a DTC in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example**, assume the

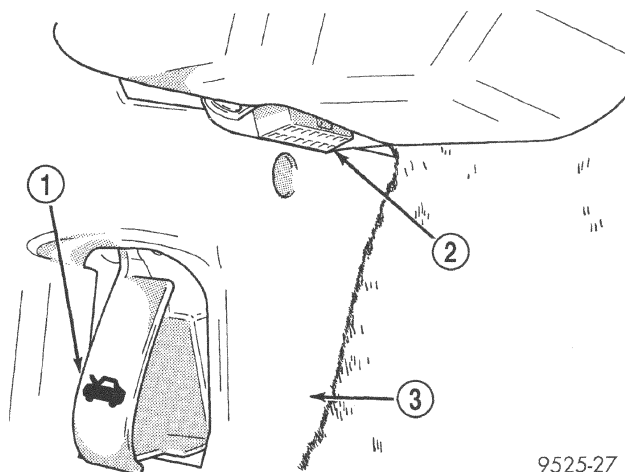
diagnostic trouble code criteria requires the PCM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the PCM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the PCM will not store a DTC.

There are several operating conditions for which the PCM monitors and sets DTC's. Refer to Monitored Systems, Components, and Non-Monitored Circuits in this section.

**NOTE:** Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, pulling a spark plug wire to perform a spark test may set the misfire code. When a repair is completed and verified, use the DRB scan tool to erase all DTC's and extinguish the MIL.

Technicians can display stored DTC's by using the DRB scan tool. Refer to Diagnostic Trouble Codes in this section. For DTC information, refer to charts in this section.



**DESCRIPTION AND OPERATION (Continued)**

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**Fig. 1 Data Link (Diagnostic) Connector**

- 1 - HOOD RELEASE
- 2 - DIAGNOSTIC CONNECTOR
- 3 - DRIVER'S SIDE KICK PANEL

**MALFUNCTION INDICATOR LAMP (MIL)****OPERATION**

As a functional test, the Malfunction Indicator Lamp (MIL) illuminates at key-on before engine cranking. Whenever the Powertrain Control Module (PCM) sets a Diagnostic Trouble Code (DTC) that affects vehicle emissions, it illuminates the MIL. If a problem is detected, the PCM sends a message over the CCD Bus to the instrument cluster to illuminate the lamp. The PCM illuminates the MIL only for DTC's that affect vehicle emissions. The MIL stays on continuously when the PCM has entered a Limp-In mode or identified a failed emission component or system. The MIL remains on until the DTC is erased. Refer to the Diagnostic Trouble Code charts in this group for emission related codes.

Also, the MIL either flashes or illuminates continuously when the PCM detects active engine misfire. Refer to Misfire Monitoring in this section.

Additionally, the PCM may reset (turn off) the MIL when one of the following occur:

- PCM does not detect the malfunction for 3 consecutive trips (except misfire and fuel system monitors).
- PCM does not detect a malfunction while performing three successive engine misfire or fuel system tests. The PCM performs these tests while the engine is operating within  $\pm 375$  RPM of and within 10 % of the load of the operating condition at which the malfunction was first detected.

**DRB III STATE DISPLAY TEST MODE****OPERATION**

The switch inputs to the Powertrain Control Module (PCM) have two recognized states; HIGH and LOW. For this reason, the PCM cannot recognize the difference between a selected switch position versus an open circuit, a short circuit, or a defective switch. If the State Display screen shows the change from HIGH to LOW or LOW to HIGH, assume the entire switch circuit to the PCM functions properly. From the state display screen, access either State Display Inputs and Outputs or State Display Sensors.

**DRB III CIRCUIT ACTUATION TEST MODE****OPERATION**

The Circuit Actuation Test Mode checks for proper operation of output circuits or devices the Powertrain Control Module (PCM) may not internally recognize. The PCM attempts to activate these outputs and allow an observer to verify proper operation. Most of the tests provide an audible or visual indication of device operation (click of relay contacts, fuel spray, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit work correctly.

**DIAGNOSTIC TROUBLE CODES****DESCRIPTION**

A Diagnostic Trouble Code (DTC) indicates the PCM has recognized an abnormal condition in the system.

**Remember that DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.**

**NOTE:** For a list of DTC's, refer to the charts in this section.

**OPERATION****BULB CHECK**

Each time the ignition key is turned to the ON position, the malfunction indicator (check engine) lamp on the instrument panel should illuminate for approximately 2 seconds then go out. This is done for a bulb check.

**OBTAINING DTC'S USING DRB SCAN TOOL**

(1) Connect the DRB scan tool to the data link (diagnostic) connector. This connector is located in



**DESCRIPTION AND OPERATION (Continued)**

the passenger compartment; at the lower edge of instrument panel; near the steering column.

(2) Turn the ignition switch on and access the "Read Fault" screen.

(3) Record all the DTC's and "freeze frame" information shown on the DRB scan tool.

(4) To erase DTC's, use the "Erase Trouble Code" data screen on the DRB scan tool. **Do not erase any DTC's until problems have been investigated and repairs have been performed.**

**DIAGNOSTIC TROUBLE CODE DESCRIPTIONS**

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P0106 (M)	Barometric Pressure Out of Range	MAP sensor input voltage out of an acceptable range detected during reading of barometric pressure at key-on.
P0107 (M)	Map Sensor Voltage Too Low	MAP sensor input below minimum acceptable voltage.
P0108 (M)	Map Sensor Voltage Too High	MAP sensor input above maximum acceptable voltage.
P0112 (M)	Intake Air Temp Sensor Voltage Low	Intake air (charge) temperature sensor input below the minimum acceptable voltage.
P0113 (M)	Intake Air Temp Sensor Voltage High	Intake air (charge) temperature sensor input above the maximum acceptable voltage.
P0116		A rationality error has been detected in the coolant temp sensor.
P0117 (M)	ECT Sensor Voltage Too Low	Engine coolant temperature sensor input below the minimum acceptable voltage.
P0118 (M)	ECT Sensor Voltage Too High	Engine coolant temperature sensor input above the maximum acceptable voltage.
P0121 (M)	TPS Voltage Does Not Agree With MAP	TPS signal does not correlate to MAP sensor signal.
P0122 (M)	Throttle Position Sensor Voltage Low	Throttle position sensor input below the acceptable voltage range.
P0123 (M)	Throttle Position Sensor Voltage High	Throttle position sensor input above the maximum acceptable voltage.
P0125 (M)	Closed Loop Temp Not Reached	Time to enter Closed Loop Operation (Fuel Control) is excessive.
P0130	1/1 O2 Sensor Heater Relay Circuit	An open or shorted condition detected in the ASD or CNG shutoff relay control ckt.
P0131 (M)	1/1 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0132 (M)	1/1 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0133 (M)	1/1 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0134 (M)	1/1 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor input.
P0135 (M)	1/1 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0136	1/2 O2 Sensor Heater Relay Circuit	An open or shorted condition detected in the ASD or CNG shutoff relay control ckt.

**DESCRIPTION AND OPERATION (Continued)**

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P0137 (M)	1/2 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0138 (M)	1/2 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0139 (M)	1/2 O2 Sensor Slow Response	Oxygen sensor response not as expected.
P0140 (M)	1/2 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0141 (M)	1/2 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0143	1/3 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0144	1/3 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0145	1/3 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0146	1/3 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0147	1/3 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0151 (M)	2/1 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0152 (M)	2/1 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage sustained above normal operating range.
P0153 (M)	2/1 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0154 (M)	2/1 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0155 (M)	2/1 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0157 (M)	2/2 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0158 (M)	2/2 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0159	2/2 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0160 (M)	2/2 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0161 (M)	2/2 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0165	Starter Relay Control Circuit	An open or shorted condition detected in the starter relay control circuit.
P0171 (M)	1/1 Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.
P0172 (M)	1/1 Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
P0174 (M)	2/1 Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.

**DESCRIPTION AND OPERATION (Continued)**

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P0175 (M)	2/1 Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
P0178	Water in Fuel Sensor Voltage Too Low	Flex fuel sensor input below minimum acceptable voltage.
P0179	Flex Fuel Sensor Volts Too High	Flex fuel sensor input above maximum acceptable voltage.
P0182	CNG Temp Sensor Voltage Too Low	Compressed natural gas temperature sensor voltage below acceptable voltage.
P0183	CNG Temp Sensor Voltage Too High	Compressed natural gas temperature sensor voltage above acceptable voltage.
P0201 (M)	Injector #1 Control Circuit	An open or shorted condition detected in control circuit for injector #1 or the INJ 1 injector bank.
P0202 (M)	Injector #2 Control Circuit	An open or shorted condition detected in control circuit for injector #2 or the INJ 2 injector bank.
P0203 (M)	Injector #3 Control Circuit	An open or shorted condition detected in control circuit for injector #3 or the INJ 3 injector bank.
P0204 (M)	Injector #4 Control Circuit	Injector #4 or INJ 4 injector bank output driver stage does not respond properly to the control signal.
P0205 (M)	Injector #5 Control Circuit	Injector #5 output driver stage does not respond properly to the control signal.
P0206 (M)	Injector #6 Control Circuit	Injector #6 output driver stage does not respond properly to the control signal.
P0207	Injector #7 Control Circuit	Injector #7 output driver stage does not respond properly to the control signal.
P0208	Injector #8 Control Circuit	Injector #8 output driver stage does not respond properly to the control signal.
P0209	Injector #9 Control Circuit	Injector #9 output driver stage does not respond properly to the control signal.
P0210	Injector #10 Control Circuit	Injector #10 output driver stage does not respond properly to the control signal.
P0300 (M)	Multiple Cylinder Mis-fire	Misfire detected in multiple cylinders.
P0301 (M)	CYLINDER #1 MISFIRE	Misfire detected in cylinder #1.
P0302 (M)	CYLINDER #2 MISFIRE	Misfire detected in cylinder #2.
P0303 (M)	CYLINDER #3 MISFIRE	Misfire detected in cylinder #3.
P0304 (M)	CYLINDER #4 MISFIRE	Misfire detected in cylinder #4.
P0305 (M)	CYLINDER #5 MISFIRE	Misfire detected in cylinder #5.
P0306 (M)	CYLINDER #6 MISFIRE	Misfire detected in cylinder #6.
P0307 (M)	CYLINDER #7 MISFIRE	Misfire detected in cylinder #7.
P0308 (M)	CYLINDER #8 MISFIRE	Misfire detected in cylinder #8.
P0309 (M)	CYLINDER #9 MISFIRE	Misfire detected in cylinder #9.
P0310 (M)	CYLINDER #10 MISFIRE	Misfire detected in cylinder #10.



**DESCRIPTION AND OPERATION (Continued)**

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P0320	No Crank Reference Signal at PCM	No reference signal (crankshaft position sensor) detected during engine cranking.
P0325	Knock Sensor #1 Circuit	Knock sensor (#1) signal above or below minimum acceptable threshold voltage at particular engine speeds.
P0330	Knock Sensor #2 Circuit	Knock sensor (#2) signal above or below minimum acceptable threshold voltage at particular engine speeds.
P0340 (M)	No Cam Signal At PCM	No fuel sync
P0350	Ignition Coil Draws Too Much Current	A coil (1-5) is drawing too much current.
P0351 (M)	Ignition Coil # 1 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0352 (M)	Ignition Coil # 2 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0353 (M)	Ignition Coil # 3 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0354 (M)	Ignition Coil # 4 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (High Impedance).
P0355 (M)	Ignition Coil # 5 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (High Impedance).
P0356 (M)	Ignition Coil # 6 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0357	Ignition Coil # 7 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0358	Ignition Coil # 8 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0401 (M)	EGR System Failure	Required change in air/fuel ration not detected during diagnostic test.
P0403 (M)	EGR Solenoid Circuit	An open or shorted condition detected in the EGR solenoid control circuit.
P0404 (M)	EGR Position Sensor Rationality	EGR position sensor signal does not correlate to EGR duty cycle.
P0405 (M)	EGR Position Sensor Volts Too Low	EGR position sensor input below the acceptable voltage range.
P0406 (M)	EGR Position Sensor Volts Too High	EGR position sensor input above the acceptable voltage range.
P0412	Secondary Air Solenoid Circuit	An open or shorted condition detected in the secondary air (air switching/aspirator) solenoid control circuit.
P0420 (M)	1/1 Catalytic Converter Efficiency	Catalyst 1/1 efficiency below required level.
P0432 (M)	1/2 Catalytic Converter Efficiency	Catalyst 2/1 efficiency below required level.
P0441 (M)	Evap Purge Flow Monitor	Insufficient or excessive vapor flow detected during evaporative emission system operation.
P0442 (M)	Evap Leak Monitor Medium Leak Detected	A small leak has been detected in the evaporative system.



**DESCRIPTION AND OPERATION (Continued)**

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P0443 (M)	Evap Purge Solenoid Circuit	An open or shorted condition detected in the EVAP purge solenoid control circuit.
P0455 (M)	Evap Leak Monitor Large Leak Detected	A large leak has been detected in the evaporative system.
P0456	Evap Leak Monitor Small Leak Detected	A small leak has been detected in the evaporative system.
P0460	Fuel Level Unit No Change Over Miles	No movement of fuel level sender detected.
P0461	Fuel Level Unit No Changeover Time	No level of fuel level sender detected.
P0462	Fuel Level Sending Unit Volts Too Low	Fuel level sensor input below acceptable voltage.
P0463	Fuel Level Sending Unit Volts Too High	Fuel level sensor input above acceptable voltage.
P0500 (M)	No Vehicle Speed Sensor Signal	No vehicle speed sensor signal detected during road load conditions.
P0505 (M)	Idle Air Control Motor Circuits	Replace
P0522	Oil Pressure Sens Low	Oil pressure sensor input below acceptable voltage.
P0523	Oil Pressure Sens High	Oil pressure sensor input above acceptable voltage.
P0551 (M)	Power Steering Switch Failure	Incorrect input state detected for the power steering switch circuit. PL: High pressure seen at high speed.
P0600 (M)	PCM Failure SPI Communications	No communication detected between co-processors in the control module.
P0601 (M)	Internal Controller Failure	Internal control module fault condition (check sum) detected.
P0604	Internal Trans Controller	Transmission control module RAM self test fault detected. -Aisin transmission.
P0605	Internal Trans Controller	Transmission control module ROM self test fault detected -Aisin transmission.
P0622 (G)	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
P0645	A/C Clutch Relay Circuit	An open or shorted condition detected in the A/C clutch relay control circuit.
P0700 (M)	EATX Controller DTC Present	This SBEC III or JTEC DTC indicates that the EATX or Aisin controller has an active fault and has illuminated the MIL via a CCD (EATX) or SCI (Aisin) message. The specific fault must be acquired from the EATX via CCD or from the Aisin via ISO-9141.
P0703 (M)	Brake Switch Stuck Pressed or Released	Incorrect input state detected in the brake switch circuit. (Changed from P1595).
P0711	Trans Temp Sensor, No Temp Rise After Start	Relationship between the transmission temperature and overdrive operation and/or TCC operation indicates a failure of the Transmission Temperature Sensor. OBD II Rationality.

**DESCRIPTION AND OPERATION (Continued)**

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P0712	Trans Temp Sensor Voltage Too Low	Transmission fluid temperature sensor input below acceptable voltage.
P0713	Trans Temp Sensor Voltage Too High	Transmission fluid temperature sensor input above acceptable voltage.
P0720	Low Output SPD Sensor RPM, Above 15 MPH	The relationship between the Output Shaft Speed Sensor and vehicle speed is not within acceptable limits.
P0740 (M)	Torq Con Clu, No RPM Drop at Lockup	Relationship between engine and vehicle speeds indicated failure of torque converter clutch lock-up system (TCC/PTU sol).
P0743	Torque Converter Clutch Solenoid/Trans Relay Circuits	An open or shorted condition detected in the torque converter clutch (part throttle unlock) solenoid control circuit. Shift solenoid C electrical fault - Aisin transmission
P0748	Governor Pressur Sol Control/Trans Relay Circuits	An open or shorted condition detected in the Governor Pressure Solenoid circuit or Trans Relay Circuit in JTEC RE transmissions.
P0751	O/D Switch Pressed (Lo) More Than 5 Minutes	Overdrive override switch input is in a prolonged depressed state.
P0753	Trans 3-4 Shift Sol/Trans Relay Circuits	An open or shorted condition detected in the overdrive solenoid control circuit or Trans Relay Circuit in JTEC RE transmissions.
P0756	AW4 Shift Sol B (2-3) Functional Failure	Shift solenoid B (2-3) functional fault - Aisin transmission
P0783	3-4 Shift Sol, No RPM Drop at Lockup	The overdrive solenoid is unable to engage the gear change from 3rd gear to the overdrive gear.
P0801	Reverse Gear Lockout Circuit Open or Short	An open or shorted condition detected in the transmission reverse gear lock-out solenoid control circuit.
P01192	Inlet Air Temp. Circuit Low	Inlet Air Temp. sensor input below acceptable voltage
P01193	Inlet Air Temp. Circuit High	Inlet Air Temp. sensor input above acceptable voltage.
P1195 (M)	1/1 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 1/1 during catalyst monitor test. (was P0133)
P1196 (M)	2/1 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 2/1 during catalyst monitor test. (was P0153)
P1197	1/2 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 1/2 during catalyst monitor test. (was P0139)
P1198	Radiator Temperature Sensor Volts Too High	Radiator coolant temperature sensor input above the maximum acceptable voltage.
P1199	Radiator Temperature Sensor Volts Too Low	Radiator coolant temperature sensor input below the minimum acceptable voltage.
P1281	Engine is Cold Too Long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (Thermostat).
P1282	Fuel Pump Relay Control Circuit	An open or shorted condition detected in the fuel pump relay control circuit.
P1288	Intake Manifold Short Runner Solenoid Circuit	An open or shorted condition detected in the short runner tuning valve circuit.

**DESCRIPTION AND OPERATION (Continued)**

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P1289	Manifold Tune Valve Solenoid Circuit	An open or shorted condition detected in the manifold tuning valve solenoid control circuit.
P1290	CNG Fuel System Pressure Too High	Compressed natural gas system pressure above normal operating range.
P1291	No Temp Rise Seen From Intake Heaters	Energizing Heated Air Intake does not change intake air temperature sensor an acceptable amount.
P1292	CNG Pressure Sensor Voltage Too High	Compressed natural gas pressure sensor reading above acceptable voltage.
P1293	CNG Pressure Sensor Voltage Too Low	Compressed natural gas pressure sensor reading below acceptable voltage.
P1294 (M)	Target Idle Not Reached	Target RPM not achieved during drive idle condition. Possible vacuum leak or IAC (AIS) lost steps.
P1295	No 5 Volts to TP Sensor	Loss of a 5 volt feed to the Throttle Position Sensor has been detected.
P1296	No 5 Volts to MAP Sensor	Loss of a 5 volt feed to the MAP Sensor has been detected.
P1297 (M)	No Change in MAP From Start To Run	No difference is recognized between the MAP reading at engine idle and the stored barometric pressure reading.
P1298	Lean Operation at Wide Open Throttle	A prolonged lean condition is detected during Wide Open Throttle.
P1299 (M)	Vacuum Leak Found (IAC Fully Seated)	MAP Sensor signal does not correlate to Throttle Position Sensor signal. Possible vacuum leak.
P1388	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the ASD or CNG shutoff relay control ckt.
P1389	No ASD Relay Output Voltage At PCM	No Z1 or Z2 voltage sensed when the auto shutdown relay is energized.
P1390 (M)	Timing Belt Skipped 1 Tooth or More	Relationship between Cam and Crank signals not correct.
P1391 (M)	Intermittent Loss of CMP or CKP	Loss of the Cam Position Sensor or Crank Position sensor has occurred. For PL 2.0L
P1398 (M)	Mis-Fire Adaptive Numerator at Limit	PCM is unable to learn the Crank Sensor's signal in preparation for Misfire Diagnostics. Probable defective Crank Sensor.
P1399	Wait To Start Lamp Cicuit	An open or shorted condition detected in the Wait to Start Lamp circuit.
P1403	No 5 Volts to EGR Sensor	Loss of 5v feed to the EGR position sensor.
P1476	Too Little Secondary Air	Insufficient flow of secondary air injection detected during aspirator test.(was P0411)
P1477	Too Much Secondary Air	Excessive flow of secondary air injection detected during aspirator test (was P0411).
P1478 (M)	Battery Temp Sensor Volts Out of Limit	Internal temperature sensor input voltage out of an acceptable range.
P1479	Transmission Fan Relay Circuit	An open or shorted condition detected in the transmission fan relay circuit.



**DESCRIPTION AND OPERATION (Continued)**

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P1480	PCV Solenoid Circuit	An open or shorted condition detected in the PCV solenoid circuit.
P1482	Catalyst Temperature Sensor Circuit Shorted Low	Catalyst temperature sensor circuit shorted low.
P1483	Catalyst Temperature Sensor Circuit Shorted High.	Catalyst temperature sensor circuit shorted high.
P1484	Catalytic Converter Overheat Detected	A catalyst overheat condition has been detected by the catalyst temperature sensor.
P1485	Air Injection Solenoid Circuit	An open or shorted condition detected in the air assist solenoid circuit.
P1486 (M)	Evap Leak Monitor Pinched Hose Found	LDP has detected a pinched hose in the evaporative hose system.
P1487	Hi Speed Rad Fan CTRL Relay Circuit	An open or shorted condition detected in the control circuit of the #2 high speed radiator fan control relay.
P1488	Auxiliary 5 Volt Supply Output Too Low	Auxiliary 5 volt sensor feed is sensed to be below an acceptable limit.
P1489 (M)	High Speed Fan CTRL Relay Circuit	An open or shorted condition detected in the control circuit of the high speed radiator fan control relay.
P1490 (M)	Low Speed Fan CTRL Relay Circuit	An open or shorted condition detected in control circuit of the low speed radiator fan control relay.
P1491	Rad Fan Control Relay Circuit	An open or shorted condition detected in the radiator fan control relay control circuit. This includes PWM solid state relays.
P1492 (M,G)	Ambient/Batt Temp Sen Volts Too High	External temperature sensor input above acceptable voltage.
P1493 (M,G)	Ambient/Batt Temp Sen Volts Too Low	External temperature sensor input below acceptable voltage.
P1494 (M)	Leak Detection Pump Sw or Mechanical Fault	Incorrect input state detected for the Leak Detection Pump (LDP) pressure switch.
P1495 (M)	Leak Detection Pump Solenoid Circuit	An open or shorted condition detected in the Leak Detection Pump (LDP) solenoid circuit.
P1496 (M)	5 Volt Supply, Output Too Low	5 volt sensor feed is sensed to be below an acceptable limit. ( < 4v for 4 sec ).
P1498	High Speed Rad Fan Ground CTRL Rly Circuit	An open or shorted condition detected in the control circuit of the #3 high speed radiator fan control relay.
P1594 (G)	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
P1595	Speed Control Solenoid Circuits	An open or shorted condition detected in either of the speed control vacuum or vent solenoid control circuits.
P1596	Speed Control Switch Always High	Speed control switch input above maximum acceptable voltage.
P1597	Speed Control Switch Always Low	Speed control switch input below minimum acceptable voltage.



**DESCRIPTION AND OPERATION (Continued)**

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P1598	A/C Pressure Sensor Volts Too High	A/C pressure sensor input above maximum acceptable voltage.
P1599	A/C Pressure Sensor Volts Too Low	A/C pressure sensor input below minimum acceptable voltage.
P1680	Clutch Released Switch Circuit	
P1681	No I/P Cluster CCD/J1850 Messages Received	No CCD/J1850 messages received from the cluster control module.
P1682 (G)	Charging System Voltage Too Low	Battery voltage sense input below target charging voltage during engine operation and no significant change in voltage detected during active test of generator output circuit.
P1683	SPD CTRL PWR Relay; or S/C 12v Driver CKT	An open or shorted condition detected in the speed control servo power control circuit. (SBECII: ext relay).
P1684		The battery has been disconnected within the last 50 starts.
P1685	Skim Invalid Key	The engine controller has received an invalid key from the SKIM.
P1686	No SKIM BUS Messages Received	No CCD/J1850 messages received from the Smart Key Immobilizer Module (SKIM).
P1687	No MIC BUS Message	No CCD/J1850 messages received from the Mechanical Instrument Cluster (MIC) module.
P1693	DTC Detected in Companion Module	A fault has been generated in the companion engine control module.
P1694	Fault In Companion Module	No CCD/J1850 messages received from the powertrain control module-Aisin transmission.
P1695	No CCD/J1850 Message From Body Control Module	No CCD/J1850 messages received from the body control module.
P1696 (M)	PCM Failure EEPROM Write Denied	Unsuccessful attempt to write to an EEPROM location by the control module.
P1697 (M)	PCM Failure SRI Mile Not Stored	Unsuccessful attempt to update Service Reminder Indicator (SRI or EMR) mileage in the control module EEPROM.
P1698 (M)	No CCD/J1850 Message From TCM	No CCD/J1850 messages received from the electronic transmission control module (EATX) or the Aisin transmission controller.
P1719	Skip Shift Solenoid Circuit	An open or shorted condition detected in the transmission 2-3 gear lock-out solenoid control circuit.
P1756	GOV Press Not Equal to Target @ 15-20 PSI	The requested pressure and the actual pressure are not within a tolerance band for the Governor Control System which is used to regulate governor pressure to control shifts for 1st, 2nd, and 3rd gear. (Mid Pressure Malfunction)

**DESCRIPTION AND OPERATION (Continued)**

(M) Check Engine Lamp (MIL) will illuminate during engine operation if this Diagnostic Trouble Code was recorded.		
(G) Generator Lamp Illuminated		
GENERIC SCAN TOOL CODE	DRB SCAN TOOL DISPLAY	DESCRIPTION OF DIAGNOSTIC TROUBLE CODE
P1757	GOV Press Not Equal to Target @ 15-20 PSI	The requested pressure and the actual pressure are not within a tolerance band for the Governor Control System which is used to regulate governor pressure to control shifts for 1st, 2nd, and 3rd gear (Zero Pressure Malfunction)
P1762	Gov Press Sen Offset Volts Too Lo or High	The Governor Pressure Sensor input is greater than a calibration limit or is less than a calibration limit for 3 consecutive park/neutral calibrations.
P1763	Governor Pressure Sensor Volts Too Hi	The Governor Pressure Sensor input is above an acceptable voltage level.
P1764	Governor Pressure Sensor Volts Too Low	The Governor Pressure Sensor input is below an acceptable voltage level.
P1765	Trans 12 Volt Supply Relay CTRL Circuit	An open or shorted condition is detected in the Transmission Relay control circuit. This relay supplies power to the TCC>
P1899 (M)	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch.

**MONITORED SYSTEMS****DESCRIPTION**

There are new electronic circuit monitors that check fuel, emission, engine and ignition performance. These monitors use information from various sensor circuits to indicate the overall operation of the fuel, engine, ignition and emission systems and thus the emissions performance of the vehicle.

The fuel, engine, ignition and emission systems monitors do not indicate a specific component problem. They do indicate that there is an implied problem within one of the systems and that a specific problem must be diagnosed.

If any of these monitors detect a problem affecting vehicle emissions, the Malfunction Indicator (Check Engine) Lamp will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the check engine lamp or a scan tool.

The following is a list of the monitored systems:

- EGR Monitor
- Misfire Monitor
- Fuel System Monitor
- Evaporative Emissions Monitor

Following is a description of each system monitor, and its DTC.

**Refer to the appropriate Powertrain Diagnostics Procedures manual for diagnostic procedures.**

**EGR MONITOR**

The Powertrain Control Module (PCM) performs an on-board diagnostic check of the EGR system.

The EGR system consists of two main components: a vacuum solenoid back pressure transducer and a vacuum operated valve. The EGR monitor is used to test whether the EGR system is operating within specifications. The diagnostic check activates only during selected engine/driving conditions. When the conditions are met, the EGR is turned off (solenoid energized) and the O2S compensation control is monitored. Turning off the EGR shifts the air fuel (A/F) ratio in the lean direction. Oxygen sensor voltage then indicates increased oxygen in the exhaust. Consequently, Short Term Compensation shifts to rich (increased injector pulse width). By monitoring the shift, the PCM can indirectly monitor the EGR system. While this test does not directly measure the operation of the EGR system, it can be inferred from the shift in the O2S data whether the EGR system is operating correctly. Because the O2S is being used, the O2S test must pass its test before the EGR test.

**Enabling Conditions—**

- Engine Temperature
- Engine Run Time
- Engine RPM
- MAP Sensor
- TPS
- Vehicle Speed
- Short Term Compensation



**DESCRIPTION AND OPERATION (Continued)**

**Pending Conditions—** The EGR Monitor does not run when any of the following example faults have illuminated the MIL:

- Misfire
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Fuel System Rich/Lean
- Limp in for MAP, TPS or ECT
- Vehicle Speed Sensor
- Cam or Crank Sensor
- EGR Electrical
- EVAP Electrical
- Fuel Injector
- Ignition Coil
- Idle Speed
- Engine Coolant Temperature (ECT)
- MAP Sensor
- Intake Air Temperature (IAT)

**Conflict Conditions—** The EGR Monitor typically does not run if any of the following conditions are present:

- Fuel System Monitor
- Purge Monitor
- Catalyst Monitor
- Low Fuel Level
- High Altitude
- Low Ambient Air Temperature

The EGR Monitor does not run if any of the following example DTCs are present:

- Misfire Monitor, Priority 2
- Upstream Oxygen Sensor Heater, Priority 1
- Fuel System Monitor, Priority 2
- Oxygen Sensor Monitor, Priority 1

**MISFIRE MONITOR**

Excessive engine misfire results in increased catalyst temperature and causes an increase in HC emissions. Severe misfires could cause catalyst damage. To prevent catalytic converter damage, the PCM monitors engine misfire.

The Powertrain Control Module (PCM) monitors for misfire during most engine operating conditions (positive torque) by looking at changes in the crankshaft speed. If a misfire occurs the speed of the crankshaft will vary more than normal.

OBD II regulations for misfire monitoring require two different tests for misfire. The first is a Catalyst Damage level of misfire test. The second is for emissions greater than 1.5 times the Federal Tailpipe (FTP) standards. The tests are monitored by two different counters. These counters are:

- 200 revolution increments for immediate catalyst damage
- 1000 revolution increments for emissions violation and Inspection/Maintenance (I/M) test failure

**NOTE:** The percent of misfire for malfunction criteria varies due to RPM and load. As the engine speed increases or load decreases, the effects of a misfire diminishes due to crankshaft momentum. Failure percentages also vary from engine to engine.

**Monitor Operation—** The PCM utilizes the Crankshaft Speed Fluctuation method to monitor for misfire. The misfire monitor utilizes a crankshaft position sensor to determine engine RPM. The sensor can detect slight variations in engine speed due to misfire. Misfire is continuously monitored once the enabling conditions are met.

Once enabling conditions are met, the PCM counts the number of misfires in every 200 revolutions of the crankshaft. If, during five 200 counters, the misfire percentage exceeds a predetermined value, a maturing code is set and a Freeze Frame is entered. Freeze Frame data is recorded during the last 200 revolutions of the 1000 revolution period. A failure on the second consecutive trip matures the code and a DTC is set.

If misfire continues during the initial trip, the MIL is not illuminated. However, the MIL flashes when the misfire percentage exceeds the malfunction percentage, in any 200 revolution period, that would cause permanent catalyst damage. This is a one trip monitor. If misfire reaches a point in which catalyst damage is likely to occur, the MIL flashes and a DTC is stored in a Freeze Frame. The engine defaults to open loop operation to prevent increased fuel flow to the cylinders. Once misfire is below the predetermined percentage, the MIL stops flashing but remains illuminated.

The 1000 revolution counters are two trip monitors. As with the fuel system monitor, Freeze Frame data is from the original fault, and MIL extinguishing requires the monitor to pass under similar conditions.

**The Adaptive Numerator—** The Misfire Monitor takes into account component wear, sensor fatigue and machining tolerances. The PCM compares the crankshaft in the vehicle to data on an ideal crank and uses this as a basis to determine variance. To do this, the crankshaft sensor monitors the reference notches in the crank. The PCM uses the first signal set as a point of reference. It then measures where the second set of signals is, compared to where engineering data has determined it should be. This variance is the Adaptive Numerator. The monitor will not run if the numerator is not set.

If the Adaptive Numerator is equal to the default value, the adaptive Numerator has not been learned and the Misfire Monitor does not run. If the Adaptive Numerator exceeds its limits, the PCM sets a DTC for Adaptive Numerator and illuminates the MIL.

**DESCRIPTION AND OPERATION (Continued)**

**RPM Error—** The PCM also checks the machining tolerances for each group of slots. By monitoring the speed of the crank from the first slot to the last slot in a group, the PCM can calculate engine RPM. The variance between groups of slots is known as the RPM error. In order for the PCM to run the Misfire Monitor, RPM error must be less than approximately 5%.

**Enabling Conditions—** The following conditions must be met before the PCM runs the Misfire Monitor:

- RPM
- Engine Coolant Temperature (ECT)
- Barometric Pressure (MAP)
- Fuel level
- Ambient air Temperature

**Pending Conditions—** The Misfire Monitor does not run when the MIL is illuminated for any of the following:

- Limp in mode for
- MAP
- TPS
- Crankshaft Sensor
- Engine Coolant Temperature Sensor
  - Speed Sensor DTC
  - EGR Electrical
  - EVAP Electrical
  - Idle Speed Faults
  - Intake Air Temperature
  - Oxygen Sensor Monitor
  - Oxygen Sensor Electrical

**Conflict Conditions—** If any of the following conditions conflict with the Misfire Monitor, the monitor will not run:

- Low fuel level
- MAP voltage rapidly changing
- Severe engine decel
- TPS toggling OPEN/CLOSED
- Engine RPM too low (RPM levels by vehicle)
- Engine RPM too high (RPM levels vary by vehicle)
- Full Lean or Decel Fuel Shut-off
- Cold start

**FUEL SYSTEM MONITOR**

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide. The catalyst works best when the air fuel (A/F) ratio is at or near the optimum of 14.7 to 1.

The PCM is programmed to maintain the optimum air/fuel ratio of 14.7 to 1. This is done by making short term corrections in the fuel injector pulse width based on the O2S output. The programmed memory acts as a self calibration tool that the engine controller uses to compensate for variations in engine spec-

ifications, sensor tolerances and engine fatigue over the life span of the engine. By monitoring the actual air-fuel ratio with the O2S (short term) and multiplying that with the program long-term (adaptive) memory and comparing that to the limit, it can be determined whether it will pass an emissions test. If a malfunction occurs such that the PCM cannot maintain the optimum A/F ratio, then the MIL will be illuminated.

**Monitor Operation—** Fuel systems monitors do not have a pre-test because they are continuously running monitors. Therefore, the PCM constantly monitors Short Term Compensation and Long Term Adaptive memory.

**Lean:** If at anytime during a lean engine operation, short term compensation multiplied by long term adaptive exceeds a certain percentage for an extended period, the PCM sets a Fuel System Lean Fault for that trip and a Freeze Frame is entered.

**Rich:** If at anytime during a rich operation, Short Term Compensation multiplied by Long Term Adaptive is less than a predetermined value, the PCM checks the Purge Free Cells.

Purge Free Cells are values placed in Adaptive Memory cells when the EVAP Purge Solenoid is OFF. Two, three or four Purge Free cells are used. One corresponds to an Adaptive Memory cell at idle, the other to a cell that is off-idle. For example, if a Purge Free cell is labeled PFC1, it would hold the value for Adaptive Memory cell C1 under non-purge conditions.

If all Purge Free Cells are less than a certain percentage, and the Adaptive Memory factor is less than a certain percentage, the PCM sets a Fuel System Rich fault for that trip and a Freeze Frame is entered.

The Fuel Monitor is a two trip monitor. The PCM records engine data in Freeze Frame upon setting of the first fault, or maturing code. When the fuel monitor fails on a second consecutive trip, the code is matured and the MIL is illuminated. The stored Freeze Frame data is still from the first fault.

In order for the PCM to extinguish the MIL, the Fuel Monitor must pass in a Similar Condition Window. The similar conditions relate to RPM and load. The engine must be within a predetermined percentage of both RPM and load when the monitor runs to count a good trip. As with all DTCs, three good trips are required to extinguish the MIL and 40 warm up cycles are required to erase the DTC. If the engine does not run in a Similar Conditions Window, the Task Manager extinguishes the MIL after 80 good trips.

**Enabling Conditions—** The following conditions must be met to operate the fuel control monitor:

- PCM not in fuel crank mode (engine running)



**DESCRIPTION AND OPERATION (Continued)**

- PCM in Closed Loop fuel control
- Fuel system updating Long Term Adaptive
- Fuel level above 15% of capacity
- Fuel level below 85% of capacity

**Pending Conditions—** The Fuel Control Monitor does not operate if the MIL is illuminated for any of the following:

- Misfire Monitor
- Upstream O2S
- EVAP Purge Solenoid Electrical PCM Self Test

**Fault**

- Camshaft or Crankshaft Position Sensor
- Fuel Injectors
- Ignition Coil Primary
- Throttle Position (TPS) Sensor
- Engine Coolant Temperature (ECT) Sensor
- Manifold Absolute Pressure (MAP) Sensor
- Idle Air Control (IAC)
- 5V Output Too Low
- EGR Monitor
- EGR Solenoid Circuit
- Vehicle Speed Sensor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Oxygen Sensor Electrical
- Idle Speed Rationality
- Intake Air Temperature

**Suspend—** The Task Manager will suspend maturing a Fuel System fault if any of the following are present:

- Oxygen Sensor Response, Priority 1
- O2 Heater, Priority 1
- Misfire Monitor, Priority 2

**EVAPORATIVE EMISSIONS MONITOR**

**LEAK DETECTION PUMP MONITOR—** The leak detection assembly incorporates two primary functions: it must detect a leak in the evaporative system and seal the evaporative system so the leak detection test can be run.

The primary components within the assembly are: A three port solenoid that activates both of the functions listed above; a pump which contains a switch, two check valves and a spring/diaphragm, a canister vent valve (CVV) seal which contains a spring loaded vent seal valve.

Immediately after a cold start, between predetermined temperature thresholds limits, the three port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non test conditions the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling due to the reed switch triggering of the three port solenoid that prevents the diaphragm

assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized allowing atmospheric pressure to enter the pump cavity, thus permitting the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

**Pump Mode:** The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test length.

**Test Mode:** The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the Switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5" H2O. The cycle rate of pump strokes is quite rapid as the system begins to pump up to this pressure. As the pressure increases, the cycle rate starts to drop off. If there is no leak in the system, the pump would eventually stop pumping at the equalized pressure. If there is a leak, it will continue to pump at a rate representative of the flow characteristic of the size of the leak. From this information we can determine if the leak is larger than the required detection limit (currently set at .040" orifice by CARB). If a leak is revealed during the leak test portion of the test, the test is terminated at the end of the test mode and no further system checks will be performed.

After passing the leak detection phase of the test, system pressure is maintained by turning on the LDP's solenoid until the purge system is activated. Purge activation in effect creates a leak. The cycle rate is again interrogated and when it increases due to the flow through the purge system, the leak check portion of the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

Evaporative system functionality will be verified by using the stricter evap purge flow monitor. At an appropriate warm idle the LDP will be energized to seal the canister vent. The purge flow will be clocked up from some small value in an attempt to see a shift in the O2 control system. If fuel vapor, indicated by a shift in the O2 control, is present the test is passed. If not, it is assumed that the purge system is not functioning in some respect. The LDP is again turned off and the test is ended.

**Enabling Conditions for Systems with LDP**

- Ambient Air Temperature
- Barometric Pressure
- Fuel level
- Engine Temperature
- No stalling

**DESCRIPTION AND OPERATION (Continued)**

- Battery voltage

**NON-LDP VEHICLES—** On a vehicle without an EVAP leak detection pump system, changes in short term memory and movement in target IAC at idle or idle speed change, are used to monitor the system. There are two stages for this test.

**Stage One—** Stage one is a non-intrusive test. The PCM compares adaptive memory values between purge and purge-free cells. The PCM uses these values to determine the amount of fuel vapors entering the system. If the difference between the cells exceeds a predetermined value, the test passes. If not, then the monitor advances to state two.

**Stage Two—** Once the enabling conditions are met, the PCM de-energizes the Duty Cycle Purge (DCP) solenoid. The PCM then waits until engine RPM, Short Term Compensation and Idle Air Control have all stabilized. Once stable, the PCM increments the DCP solenoid cycle rate approximately 6% every 8 engine revolutions. If during the test any one of three conditions occur before the DCP cycle reaches 100%, the EVAP system is considered to be operational and the test passes. These conditions are as follows:

- RPM rises by a predetermined amount
- Short Term drops by a predetermined amount
- Idle Air Control closes by a predetermined amount

When none of the previous conditions occur, the test fails and the PCM increments a counter by one. When the PCM runs the test three times during a trip, and the counter has been incremented to three, the monitor fails and a Freeze Frame is stored.

**Enabling Conditions (Stage Two)—** The following conditions must be met to enable the EVAP Monitor (without LDP)

- Ambient Air Temperature
- Barometric Pressure
- Fuel level
- Engine Temperature
- Engine run time
- RPM stable
- MAP
- Generator, radiator fans, A/C clutch

**Pending Conditions-With or Without LDP—** The EVAP Monitor is suspended and does not run, when the MIL is illuminated due to any of the following faults:

- Misfire
- Oxygen Sensor Monitor
- Fuel System Rich
- Fuel System Lean
- EGR Monitor
- MAP
- TPS
- ECT

- DCP Solenoid

**Conflict Conditions-With or Without LDP—**

The EVAP Monitor does not run if any of the following tests are in progress:

- Catalyst
- EGR
- Fuel System
- Misfire

**TRIP DEFINITION****OPERATION**

A "Trip" means vehicle operation (following an engine-off period) of duration and driving mode such that all components and systems are monitored at least once by the diagnostic system. The monitors must successfully pass before the PCM can verify that a previously malfunctioning component is meeting the normal operating conditions of that component. For misfire or fuel system malfunction, the MIL may be extinguished if the fault does not recur when monitored during three subsequent sequential driving cycles in which conditions are similar to those under which the malfunction was first determined.

Anytime the MIL is illuminated, a DTC is stored. The DTC can self erase only when the MIL has been extinguished. Once the MIL is extinguished, the PCM must pass the diagnostic test for the most recent DTC for 40 warm-up cycles (80 warm-up cycles for the Fuel System Monitor and the Misfire Monitor). A warm-up cycle can best be described by the following:

- The engine must be running
- A rise of 40°F in engine temperature must occur from the time when the engine was started
- Engine coolant temperature must reach at least 160°F
- A "driving cycle" that consists of engine start up and engine shut off.

Once the above conditions occur, the PCM is considered to have passed a warm-up cycle. Due to the conditions required to extinguish the MIL and erase the DTC, it is most important that after a repair has been made, all DTC's be erased and the repair verified.

**MONITORED COMPONENT****DESCRIPTION**

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (Check Engine) will illuminate.

Some of the component monitors are checking for proper operation of the part. Electrically operated



## DESCRIPTION AND OPERATION (Continued)

components now have input (rationality) and output (functionality) checks. Previously, a component like the Throttle Position sensor (TPS) was checked by the PCM for an open or shorted circuit. If one of these conditions occurred, a DTC was set. Now there is a check to ensure that the component is working. This is done by watching for a TPS indication of a greater or lesser throttle opening than MAP and engine rpm indicate. In the case of the TPS, if engine vacuum is high and engine rpm is 1600 or greater and the TPS indicates a large throttle opening, a DTC will be set. The same applies to low vacuum and 1600 rpm.

Any component that has an associated limp in will set a fault after 1 trip with the malfunction present.

Refer to the Diagnostic Trouble Codes Description Charts in this section and the appropriate Powertrain Diagnostic Procedure Manual for diagnostic procedures.

The following is a list of the monitored components:

- Comprehensive Components
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor

### COMPREHENSIVE COMPONENTS

Along with the major monitors, OBD II requires that the diagnostic system monitor any component that could affect emissions levels. In many cases, these components were being tested under OBD I. The OBD I requirements focused mainly on testing emissions-related components for electrical opens and shorts.

However, OBD II also requires that inputs from powertrain components to the PCM be tested for **rationality**, and that outputs to powertrain components from the PCM be tested for **functionality**. Methods for monitoring the various Comprehensive Component monitoring include:

- (1) Circuit Continuity
  - Open
  - Shorted high
  - Shorted to ground
- (2) Rationality or Proper Functioning
  - Inputs tested for rationality
  - Outputs tested for functionality

**NOTE: Comprehensive component monitors are continuous. Therefore, enabling conditions do not apply.**

**Input Rationality—** While input signals to the PCM are constantly being monitored for electrical opens and shorts, they are also tested for rationality. This means that the input signal is compared against

other inputs and information to see if it makes sense under the current conditions.

PCM sensor inputs that are checked for rationality include:

- Manifold Absolute Pressure (MAP) Sensor
- Oxygen Sensor (O2S)
- Engine Coolant Temperature (ECT) Sensor
- Camshaft Position (CMP) Sensor
- Vehicle Speed Sensor
- Crankshaft Position (CKP) Sensor
- Intake Air Temperature (IAT) Sensor
- Throttle Position (TPS) Sensor
- Ambient/Battery Temperature Sensors
- Power Steering Switch
- Oxygen Sensor Heater
- Engine Controller
- Brake Switch
- Leak Detection Pump Switch
- P/N Switch
- Trans Controls

**Output Functionality—** PCM outputs are tested for functionality in addition to testing for opens and shorts. When the PCM provides a voltage to an output component, it can verify that the command was carried out by monitoring specific input signals for expected changes. For example, when the PCM commands the Idle Air Control (IAC) Motor to a specific position under certain operating conditions, it expects to see a specific (target) idle speed (RPM). If it does not, it stores a DTC.

PCM outputs monitored for functionality include:

- Fuel Injectors
- Ignition Coils
- Torque Converter Clutch Solenoid
- Idle Air Control
- Purge Solenoid
- EGR Solenoid
- LDP Solenoid
- Radiator Fan Control
- Trans Controls

### OXYGEN SENSOR (O2S) MONITOR

**DESCRIPTION—** Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. When there is a large amount of oxygen in the exhaust caused by a lean condition, the sensor produces a low voltage, below 450 mV. When the oxygen content is lower, caused by a rich condition, the sensor produces a higher voltage, above 450mV.

The information obtained by the sensor is used to calculate the fuel injector pulse width. This main-

**DESCRIPTION AND OPERATION (Continued)**

tains a 14.7 to 1 air fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrous oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the EGR, Catalyst and Fuel Monitors.

The O2S may fail in any or all of the following manners:

- Slow response rate (Big Slope)
- Reduced output voltage (Half Cycle)
- Heater Performance

**Slow Response Rate (Big Slope)**— Response rate is the time required for the sensor to switch from lean to rich signal output once it is exposed to a richer than optimum A/F mixture or vice versa. As the PCM adjusts the air/fuel ratio, the sensor must be able to rapidly detect the change. As the sensor ages, it could take longer to detect the changes in the oxygen content of the exhaust gas. The rate of change that an oxygen sensor experiences is called 'Big Slope'. The PCM checks the oxygen sensor voltage in increments of a few milliseconds.

**Reduced Output Voltage (Half Cycle)**— The output voltage of the O2S ranges from 0 to 1 volt. A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value. Each time the voltage signal surpasses the threshold, a counter is incremented by one. This is called the Half Cycle Counter.

**Heater Performance**— The heater is tested by a separate monitor. Refer to the Oxygen Sensor Heater Monitor.

**OPERATION**— As the Oxygen Sensor signal switches, the PCM monitors the half cycle and big slope signals from the oxygen sensor. If during the test neither counter reaches a predetermined value, a malfunction is entered and a Freeze Frame is stored. Only one counter reaching its predetermined value is needed for the monitor to pass.

The Oxygen Sensor Monitor is a two trip monitor that is tested only once per trip. When the Oxygen Sensor fails the test in two consecutive trips, the MIL is illuminated and a DTC is set. The MIL is extinguished when the Oxygen Sensor monitor passes in three consecutive trips. The DTC is erased from memory after 40 consecutive warm-up cycles without test failure.

**Enabling Conditions**— The following conditions must typically be met for the PCM to run the oxygen sensor monitor:

- Battery voltage
- Engine temperature

- Engine run time
- Engine run time at a predetermined speed
- Engine run time at a predetermined speed and throttle opening

- Transmission in gear (automatic only)
- Fuel system in Closed Loop
- Long Term Adaptive (within parameters)
- Power Steering Switch in low PSI (no load)
- Engine at idle
- Fuel level above 15%
- Ambient air temperature
- Barometric pressure
- Engine RPM within acceptable range of desired idle

- Closed throttle speed

**Pending Conditions**— The Task Manager typically does not run the Oxygen Sensor Monitor if overlapping monitors are running or the MIL is illuminated for any of the following:

- Misfire Monitor
- Front Oxygen Sensor and Heater Monitor
- MAP Sensor
- Vehicle Speed Sensor
- Engine Coolant Temperature Sensor
- Throttle Position Sensor
- Engine Controller Self Test Faults
- Cam or Crank Sensor
- Injector and Coil
- Idle Air Control Motor
- EVAP Electrical
- EGR Solenoid Electrical
- Intake Air Temperature
- 5 Volt Feed

**Conflict**— The Task Manager does not run the Oxygen Sensor Monitor if any of the following conditions are present:

- A/C ON (A/C clutch cycling temporarily suspends monitor)
- Purge flow in progress

**Suspend**— The Task Manager suspends maturing a fault for the Oxygen Sensor Monitor if any of the following are present:

- Oxygen Sensor Heater Monitor, Priority 1
- Misfire Monitor, Priority 2

**OXYGEN SENSOR HEATER MONITOR**

**DESCRIPTION**— If there is an oxygen sensor (O2S) DTC as well as a O2S heater DTC, the O2S fault MUST be repaired first. After the O2S fault is repaired, verify that the heater circuit is operating correctly.

The voltage readings taken from the O2S are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat



## DESCRIPTION AND OPERATION (Continued)

the O2S must be tested to ensure that it is heating the sensor properly.

The heater element itself is not tested. The sensor output is used to test the heater by isolating the effect of the heater element on the O2S output voltage from the other effects. The resistance is normally between 100 ohms and 4.5 megaohms. When oxygen sensor temperature increases, the resistance in the internal circuit decreases. The PCM sends a 5 volts biased signal through the oxygen sensors to ground this monitoring circuit. As the temperature increases, resistance decreases and the PCM detects a lower voltage at the reference signal. Inversely, as the temperature decreases, the resistance increases and the PCM detects a higher voltage at the reference signal. The O2S circuit is monitored for a drop in voltage.

**OPERATION—** The Oxygen Sensor Heater Monitor begins after the ignition has been turned OFF and the O2 sensors have cooled. The PCM sends a 5 volt bias to the oxygen sensor every 1.6 seconds. The PCM keeps it biased for 35 ms each time. As the sensor cools down, the resistance increases and the PCM reads the increase in voltage. Once voltage has increased to a predetermined amount, higher than when the test started, the oxygen sensor is cool enough to test heater operation.

When the oxygen sensor is cool enough, the PCM energizes the ASD relay. Voltage to the O2 sensor begins to increase the temperature. As the sensor temperature increases, the internal resistance decreases. The PCM continues biasing the 5 volt signal to the sensor. Each time the signal is biased, the PCM reads a voltage decrease. When the PCM detects a voltage decrease of a predetermined value for several biased pulses, the test passes.

The heater elements are tested each time the engine is turned OFF if all the enabling conditions are met. If the monitor fails, the PCM stores a maturing fault and a Freeze Frame is entered. If two consecutive tests fail, a DTC is stored. Because the ignition is OFF, the MIL is illuminated at the beginning of the next key cycle.

**Enabling Conditions—** The following conditions must be met for the PCM to run the oxygen sensor heater test:

- Engine run time of at least 5.1 minutes
- Key OFF power down
- Battery voltage of at least 10 volts
- Sufficient Oxygen Sensor cool down

**Pending Conditions—** There are not conditions or situations that prompt conflict or suspension of testing. The oxygen sensor heater test is not run pending resolution of MIL illumination due to oxygen sensor failure.

**Suspend—** There are no conditions which exist for suspending the Heater Monitor.

## CATALYST MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

Normal vehicle miles or engine misfire can cause a catalyst to decay. A meltdown of the ceramic core can cause a reduction of the exhaust passage. This can increase vehicle emissions and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S's) to monitor the efficiency of the converter. The dual O2S strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a lean condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstream O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S's.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S's is counted. The ratio of downstream switches to upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL (check engine lamp) will be illuminated.

**Monitor Operation—** To monitor catalyst efficiency, the PCM expands the rich and lean switch points of the heated oxygen sensor. With extended

**DESCRIPTION AND OPERATION (Continued)**

switch points, the air/fuel mixture runs richer and leaner to overburden the catalytic converter. Once the test is started, the air/fuel mixture runs rich and lean and the O<sub>2</sub> switches are counted. A switch is counted when an oxygen sensor signal goes from below the lean threshold to above the rich threshold. The number of Rear O<sub>2</sub> sensor switches is divided by the number of Front O<sub>2</sub> sensor switches to determine the switching ratio.

The test runs for 20 seconds. As catalyst efficiency deteriorated over the life of the vehicle, the switch rate at the downstream sensor approaches that of the upstream sensor. If at any point during the test period the switch ratio reaches a predetermined value, a counter is incremented by one. The monitor is enabled to run another test during that trip. When the test fails three times, the counter increments to three, a malfunction is entered, and a Freeze Frame is stored. When the counter increments to three during the next trip, the code is matured and the MIL is illuminated. If the test passes the first, no further testing is conducted during that trip.

The MIL is extinguished after three consecutive good trips. The good trip criteria for the catalyst monitor is more stringent than the failure criteria. In order to pass the test and increment one good trip, the downstream sensor switch rate must be less than 80% of the upstream rate (60% for manual transmissions). The failure percentages are 90% and 70% respectively.

**Enabling Conditions—** The following conditions must typically be met before the PCM runs the catalyst monitor. Specific times for each parameter may be different from engine to engine.

- Accumulated drive time
- Enable time
- Ambient air temperature
- Barometric pressure
- Catalyst warm-up counter
- Engine coolant temperature
- Accumulated throttle position sensor
- Vehicle speed
- MAP
- RPM
- Engine in closed loop
- Fuel level

**Pending Conditions—**

- Misfire DTC
- Front Oxygen Sensor Response
- Front Oxygen Sensor Heater Monitor
- Front Oxygen Sensor Electrical
- Rear Oxygen Sensor Rationality (middle check)
- Rear Oxygen Sensor Heater Monitor
- Rear Oxygen Sensor Electrical
- Fuel System Monitor
- All TPS faults

- All MAP faults
- All ECT sensor faults
- Purge flow solenoid functionality
- Purge flow solenoid electrical
- All PCM self test faults
- All CMP and CKP sensor faults
- All injector and ignition electrical faults
- Idle Air Control (IAC) motor functionality
- Vehicle Speed Sensor
- Brake switch
- Intake air temperature

**Conflict—** The catalyst monitor does not run if any of the following are conditions are present:

- EGR Monitor in progress
- Fuel system rich intrusive test in progress
- EVAP Monitor in progress
- Time since start is less than 60 seconds
- Low fuel level
- Low ambient air temperature

**Suspend—** The Task Manager does not mature a catalyst fault if any of the following are present:

- Oxygen Sensor Monitor, Priority 1
- Upstream Oxygen Sensor Heater, Priority 1
- EGR Monitor, Priority 1
- EVAP Monitor, Priority 1
- Fuel System Monitor, Priority 2
- Misfire Monitor, Priority 2

**NON-MONITORED CIRCUITS****OPERATION**

The PCM does not monitor all circuits, systems and conditions that could have malfunctions causing driveability problems. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems or components. For example, a fuel pressure problem will not register a fault directly, but could cause a rich/lean condition or misfire. This could cause the PCM to store an oxygen sensor or misfire diagnostic trouble code.

The major non-monitored circuits are listed below along with examples of failures modes that do not directly cause the PCM to set a DTC, but for a system that is monitored.

**FUEL PRESSURE**

The fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor or fuel system diagnostic trouble code.

**DESCRIPTION AND OPERATION (Continued)****SECONDARY IGNITION CIRCUIT**

The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

**CYLINDER COMPRESSION**

The PCM cannot detect uneven, low, or high engine cylinder compression.

**EXHAUST SYSTEM**

The PCM cannot detect a plugged, restricted or leaking exhaust system. It may set a EGR or Fuel system fault or O2S.

**FUEL INJECTOR MECHANICAL MALFUNCTIONS**

The PCM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a rich or lean condition causing the PCM to store a diagnostic trouble code for either misfire, an oxygen sensor, or the fuel system.

**EXCESSIVE OIL CONSUMPTION**

Although the PCM monitors engine exhaust oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

**THROTTLE BODY AIR FLOW**

The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

**VACUUM ASSIST**

The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control

system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

**PCM SYSTEM GROUND**

The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition. The module should be mounted to the body at all times, also during diagnostic.

**PCM CONNECTOR ENGAGEMENT**

The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

**HIGH AND LOW LIMITS****OPERATION**

The PCM compares input signal voltages from each input device with established high and low limits for the device. If the input voltage is not within limits and other criteria are met, the PCM stores a diagnostic trouble code in memory. Other diagnostic trouble code criteria might include engine RPM limits or input voltages from other sensors or switches that must be present before verifying a diagnostic trouble code condition.

**SPECIFICATIONS****LOAD VALUE**

ENGINE	IDLE/NEUTRAL	2500 RPM/NEUTRAL
2.4L DOHC	2% to 8% of Maximum Load	7% to 15% of Maximum Load
2.5L SOHC	2% to 8% of Maximum Load	7% to 15% of Maximum Load



## EVAPORATIVE EMISSION CONTROLS

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### DESCRIPTION AND OPERATION

#### EVAPORATION CONTROL SYSTEM

##### OPERATION

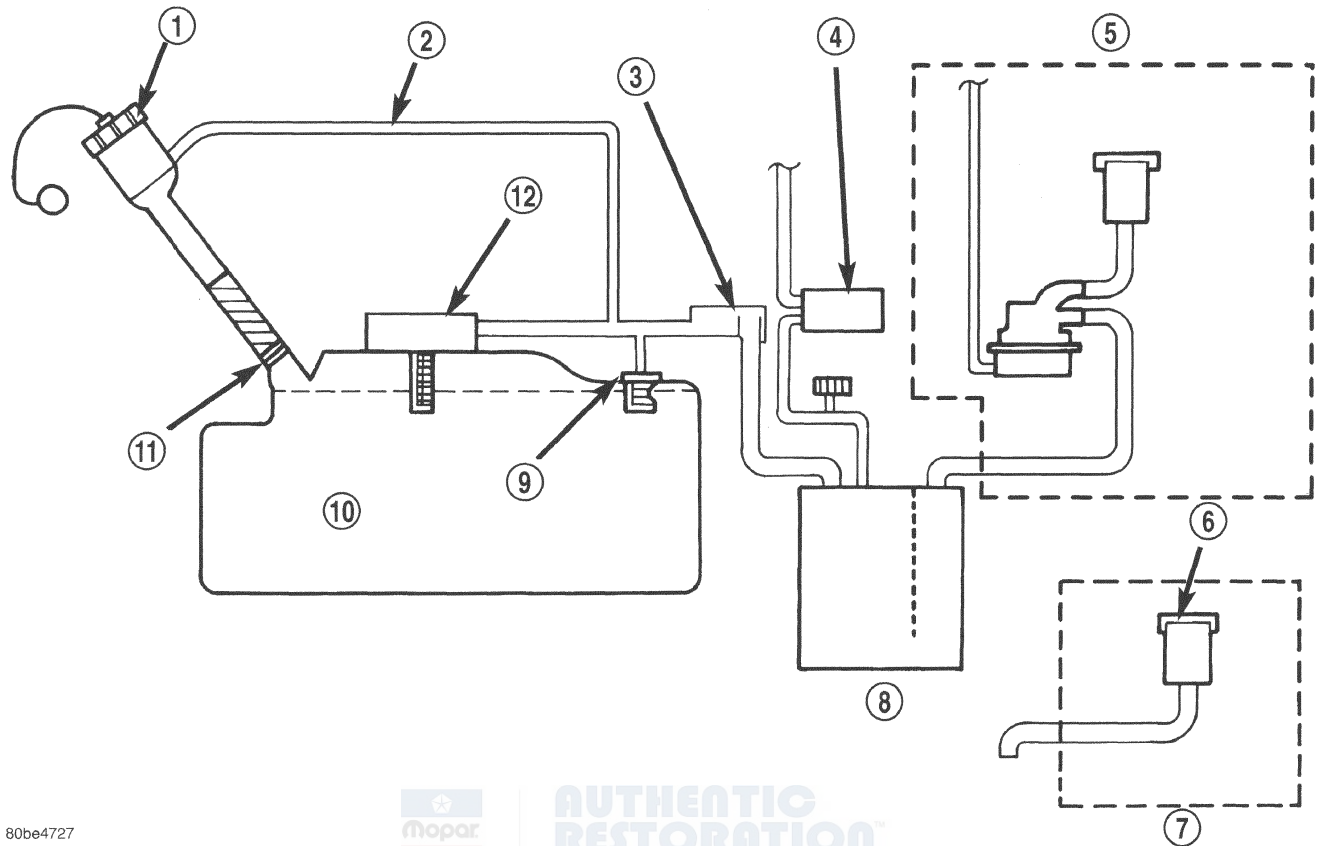
The evaporation control system prevents the emission of fuel tank vapors into the atmosphere. When fuel evaporates in the fuel tank, the vapors pass through vent hoses or tubes to an activated carbon filled evaporative canister. The canister temporarily holds the vapors. The Powertrain Control Module (PCM) allows intake manifold vacuum to draw vapors into the combustion chambers during certain operating conditions.

All engines use a proportional purge solenoid system. The PCM controls vapor flow by operating the purge solenoid. Refer to Proportional Purge Solenoid in this section.

**NOTE:** The evaporative system uses specially manufactured hoses. If they need replacement, only use fuel resistant hose. Also the hoses must be able to pass an Ozone compliance test.

**NOTE:** For more information on Onboard Refueling Vapor Recovery (ORVR), refer to the Fuel Delivery section.



**DESCRIPTION AND OPERATION (Continued)**

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**AUTHENTIC  
RESTORATION  
PRODUCT**

**ORVR System Schematic**

- 1 - FUEL CAP
- 2 - RECIRCULATION TUBE
- 3 - LIQUID SEPARATOR
- 4 - PURGE
- 5 - W/LDP
- 6 - BREATHER ELEMENT

- 7 - W/O LDP
- 8 - CANISTER
- 9 - ROLLOVER VALVE
- 10 - FUEL TANK
- 11 - CHECK VALVE
- 12 - CONTROL VALVE

**EVAP CANISTER****DESCRIPTION**

The canister mounts to a bracket on top of the fuel tank (Fig. 1). The vacuum and vapor tube connect to the top of the canister.

**OPERATION**

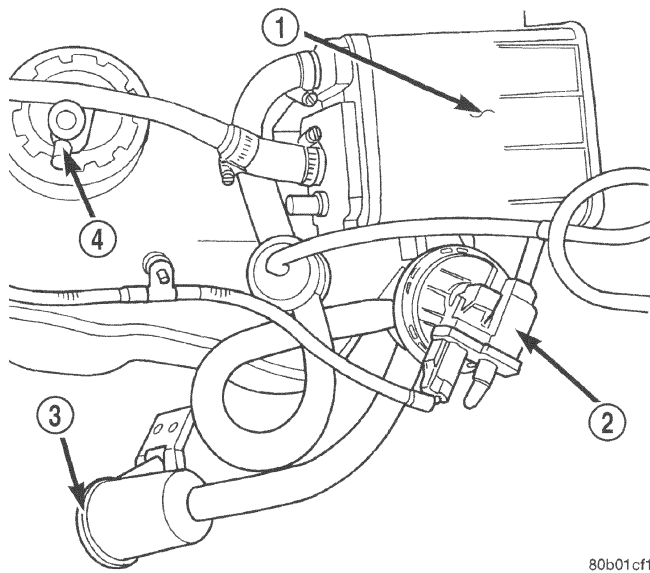
All vehicles use a sealed, maintenance free, evaporative (EVAP) canister. Fuel tank pressure vents into the canister. The canister temporarily holds the fuel vapors until intake manifold vacuum draws them into the combustion chamber. The Powertrain Control Module (PCM) purges the canister through the duty cycle EVAP purge solenoid. The PCM purges the canister at predetermined intervals and engine conditions.

**PROPORTIONAL PURGE SOLENOID****DESCRIPTION****OPERATION**

All vehicles use a proportional purge solenoid. The solenoid regulates the rate of vapor flow from the EVAP canister to the throttle body. The PCM operates the solenoid.

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged.

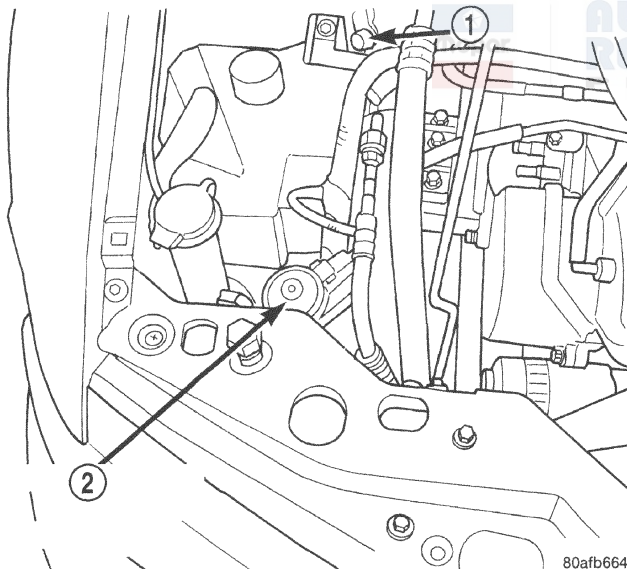
The proportional purge solenoid operates at a frequency of 200 hz and is controlled by an engine controller circuit that senses the current being applied to the proportional purge solenoid and then adjusts that current to achieve the desired purge flow. The proportional purge solenoid controls the purge rate of

**DESCRIPTION AND OPERATION (Continued)**

80b01cf1

**Fig. 1 EVAP Canister**

- 1 - EVAP CANISTER
- 2 - LDP
- 3 - LDP FILTER
- 4 - ORVR VALVE



80afb664

**Fig. 2 Proportional Purge Solenoid**

- 1 - TEST PORT
- 2 - PROPORTIONAL PURGE SOLENOID

fuel vapors from the vapor canister and fuel tank to the engine intake manifold.

**LEAK DETECTION PUMP****DESCRIPTION**

The leak detection pump is a device used to detect a leak in the evaporative system.

The pump contains a 3 port solenoid, a pump that contains a switch, a spring loaded canister vent valve seal, 2 check valves and a spring/diaphragm.

**OPERATION**

Immediately after a cold start, when the engine temperature is between 40°F and 86°F, the 3 port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non-test conditions, the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling. This is due to the operation of the 3 port solenoid which prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized, allowing atmospheric pressure to enter the pump cavity. This permits the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de-energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

**PUMP MODE:** The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test time.

**TEST MODE:** The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5 inches of water.

When the pump starts, the cycle rate is quite high. As the system becomes pressurized, pump rate drops. If there is no leak, the pump will quit. If there is a leak, the test is terminated at the end of the test mode.

If there is no leak, the purge monitor is run. If the cycle rate increases due to the flow through the purge system, the test is passed and the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

**LEAK DETECTION PUMP PRESSURE SWITCH****OPERATION**

The leak detection pump LDP assembly incorporates two primary functions: it detects a leak in the evaporative system, and it seals the evaporative system so that the required leak detection monitor test can be run.

## DESCRIPTION AND OPERATION (Continued)

The primary components within the leak detection pump assembly are: a three-port leak detection solenoid valve, a pump assembly that includes a spring loaded diaphragm, a reed switch which is used to monitor the pump diaphragm movement (position), two check valves, and a spring loaded vent seal valve.

The three-port LDP solenoid valve is used to expose either engine vacuum or atmospheric pressure to the top side of the leak detection pump diaphragm.

When the LDP solenoid valve is deenergized its port (opening) to engine vacuum is blocked off. This allows ambient air (atmospheric pressure) to enter the top of the pump diaphragm. The spring load on the diaphragm will push the diaphragm down, as long as there is no pressure present in the rest of the evaporative system. If there is sufficient evaporative system pressure present, then the pump diaphragm will stay in the "up" position. If the evaporative system pressure decays, then the pump diaphragm will eventually fall. The rate of this decent is dependent upon the size of the evaporative system leak (Large or small).

When the LDP solenoid valve is energized the port (opening) to atmosphere is blocked off. At the same time, the port to engine vacuum is opened. Engine vacuum replaces atmospheric pressure. When engine vacuum is sufficient, it over comes the spring pressure load on the pump diaphragm and causes the diaphragm to rise to its "up" position. The reed switch will change state depending upon the position of the pump diaphragm.

If the diaphragm is in the "up" position the reed switch will be in its "open" state. This means that the 12 volt signal sense to the PCM is interrupted. Zero volts is detected by the PCM. If the pump diaphragm is in the "down" position the reed switch will be in its "closed" state. 12 volts is sent to the PCM via the switch sense circuit.

The check valves are one-way valves. The first check valve is used to draw outside air into the lower chamber of the LDP (the space that is below the pump diaphragm). The second check valve is used to vent this outside air, which has become pressurized from the fall of the pump diaphragm, into the evaporative system.

The spring loaded vent seal valve, inside the LDP is used to seal off the evaporative system. When the pump diaphragm is in the "up" position the spring pushes the vent seal valve closed. The vent seal valve opens only when the pump diaphragm is in its "full down" position. When the pump assembly is in its pump mode the pump diaphragm is not allowed to descend (fall) so far as to allow the vent seal valve to open. This allows the leak detection pump to develop

the required pressure within the evaporative system for system leak testing.

A pressure build up within the evaporative system may cause pressure on the lower side of the LDP diaphragm. This will cause the LDP diaphragm to remain in its "up" position (stuck in the up position). This condition can occur even when the solenoid valve is deenergized. This condition can be caused by previous cycling (pumping) of the LDP by the technician (dealer test). Another way that this condition is created is immediately following the running of the vehicle evaporative system monitor. In this case, the PCM has not yet opened the proportional purge solenoid in order to vent the pressure that has been built up in the evaporative system to the engine combustion system. The technician will need to vent the evaporative system pressure via the vehicle fuel filler cap and its fuel filler secondary seal (if so equipped in the fuel filler neck). This will allow the technician to cycle the LDP and to watch switch state changes.

After passing the leak detection phase of the test, system pressure is maintained until the purge system is activated, in effect creating a leak. If the diaphragm falls (as is expected), causing the reed switch to change state, then the diagnostic test is completed.

When of the evaporative system leak monitor begins its various tests, a test is performed to determine that no part of the evaporative system is blocked. In this test, the LDP is cycled (pumped) a calibrated (few) number of times. Pressure should not build up in the evaporative system. If pressure is present, then LDP diaphragm is forced to stay in its "up" position. The reed switch now stays open and the PCM senses this open (incorrect) state. The evaporative system monitor will fail the test because of a detected obstruction within the system.

### **Possible causes:**

- Open or shorted LDP switch sense circuit
- Leak Detection Pump switch failure
- Open fused ignition switch output
- Restricted, disconnected, or blocked manifold vacuum source
- Obstruction of hoses or lines
- PCM failure

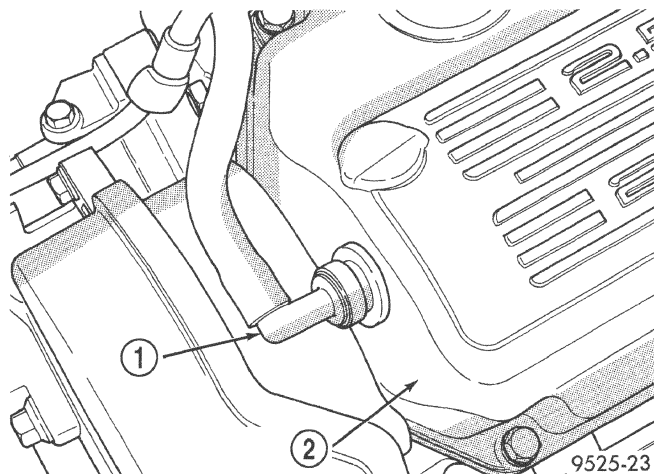
## POSITIVE CRANKCASE VENTILATION (PCV) SYSTEMS

### DESCRIPTION

### OPERATION

Intake manifold vacuum removes crankcase vapors and piston blow-by from the engine (Fig. 3). The emissions pass through the PCV valve into the intake manifold where they become part of the cali-



**DESCRIPTION AND OPERATION (Continued)****Fig. 3 PCV System—2.5L**

- 1 - PCV VALVE  
2 - FRONT VALVE COVER

brated air-fuel mixture. They are burned and expelled with the exhaust gases. The air cleaner supplies make up air when the engine does not have enough vapor or blow-by gases. In this system, fresh air does not enter the crankcase.

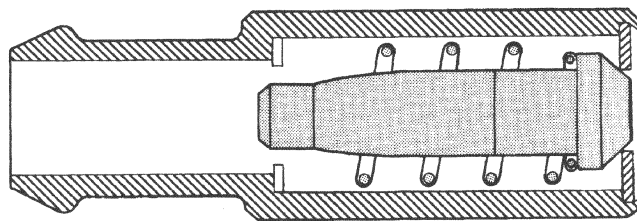
**POSITIVE CRANKCASE VENTILATION VALVE****OPERATION**

The PCV valve contains a spring loaded plunger. The plunger meters the amount of crankcase vapors routed into the combustion chamber based on intake manifold vacuum.

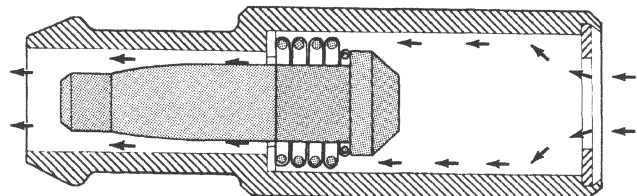
When the engine is not operating or during an engine backfire, the spring forces the plunger back against the seat. This prevents vapors from flowing through the valve (Fig. 4).

When the engine is at idle or cruising, high manifold vacuum is present. At these times manifold vacuum is able to completely compress the spring and pull the plunger to the top of the valve (Fig. 5). In this position there is minimal vapor flow through the valve.

During periods of moderate intake manifold vacuum the plunger is only pulled part way back from



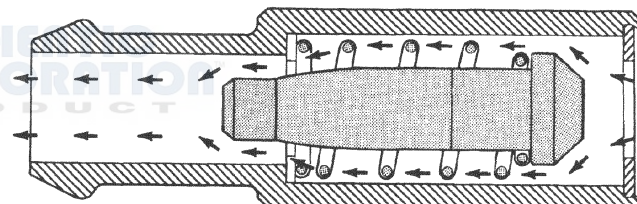
J9025-20

**Fig. 4 Engine Off or Engine Backfire—No Vapor Flow**

J8925-14

**Fig. 5 High Intake Manifold Vacuum—Minimal Vapor Flow**

the inlet. This results in maximum vapor flow through the valve (Fig. 6).



J8925-15

**Fig. 6 Moderate Intake Manifold Vacuum—Maximum Vapor Flow****VEHICLE EMISSION CONTROL INFORMATION LABEL****DESCRIPTION**

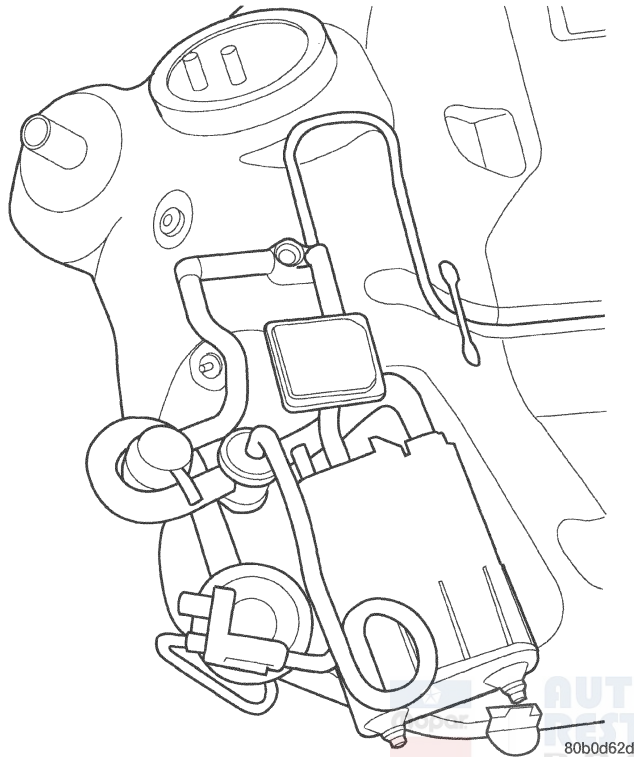
All models have a Vehicle Emission Control Information (VECI) Label. Chrysler permanently attaches the label in the engine compartment. It cannot be removed without defacing information and destroying the label.

The label contains the vehicle's emission specifications and vacuum hose routings. All hoses must be connected and routed according to the label.

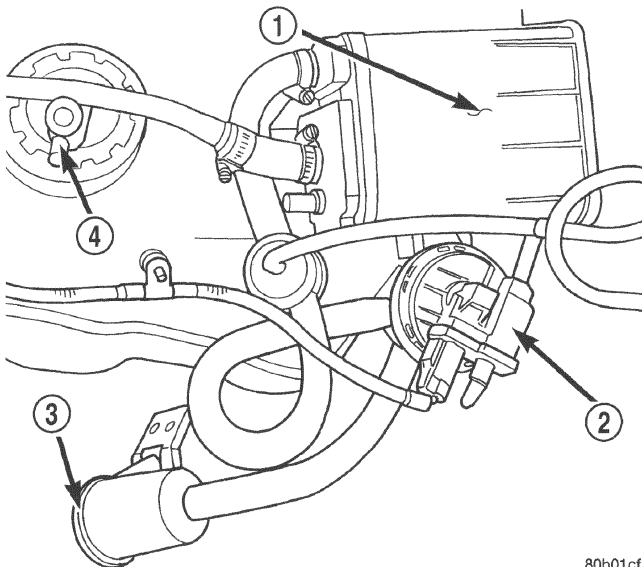


## REMOVAL AND INSTALLATION

### LEAK DETECTION PUMP



**Fig. 7 Fuel Tank Assembly**



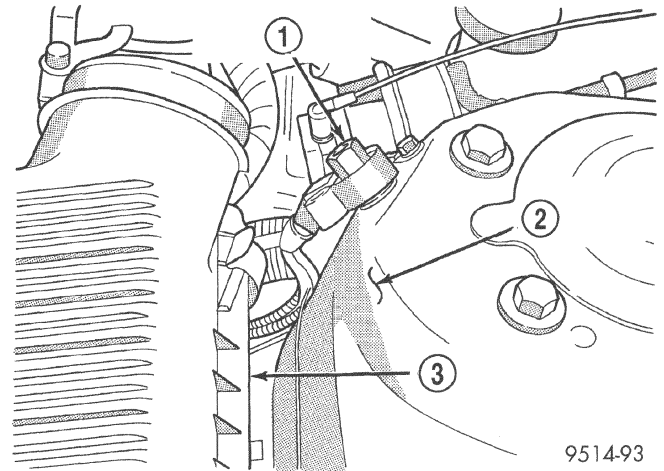
**Fig. 8 EVAP System**

- 1 - EVAP CANISTER
- 2 - LDP
- 3 - LDP FILTER
- 4 - ORVR VALVE

### REMOVAL

(1) Release fuel pressure, Refer to Fuel System Pressure Release Procedure in the Fuel Delivery section.

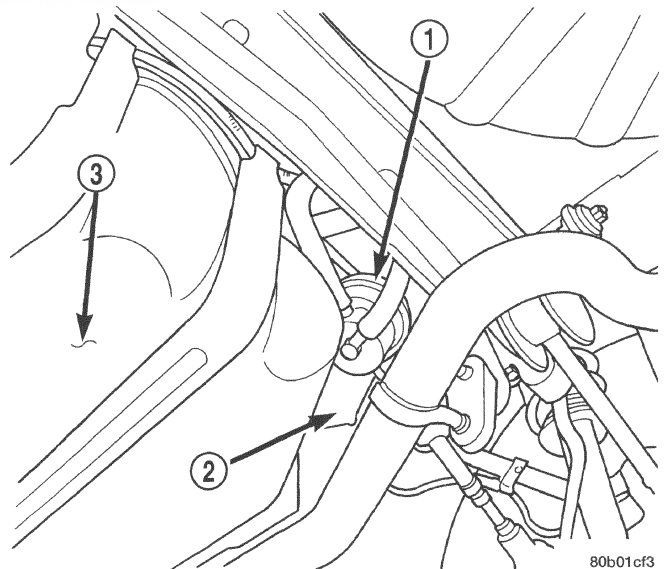
(2) Disconnect battery cable (Fig. 9).



**Fig. 9 Battery Cable**

- 1 - AUXILIARY JUMPER TERMINAL
- 2 - LEFT STRUT TOWER
- 3 - AIR CLEANER HOUSING

(3) Raise vehicle and support.

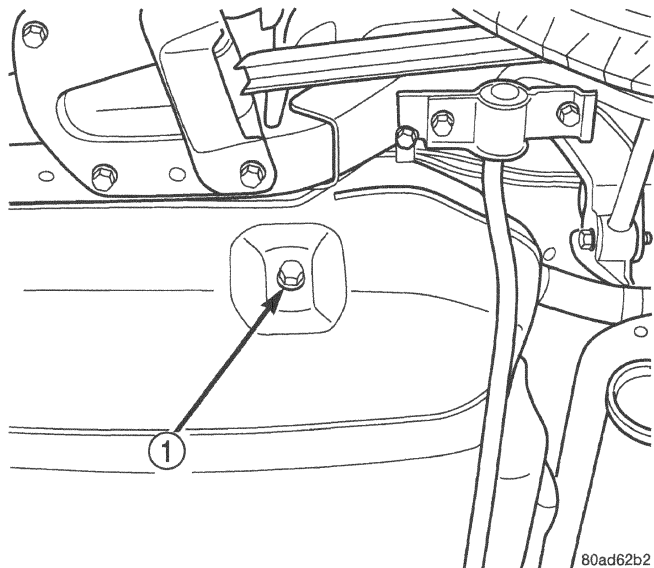


**Fig. 10 EVAP System**

- 1 - LDP
- 2 - EVAP CANISTER
- 3 - FUEL TANK

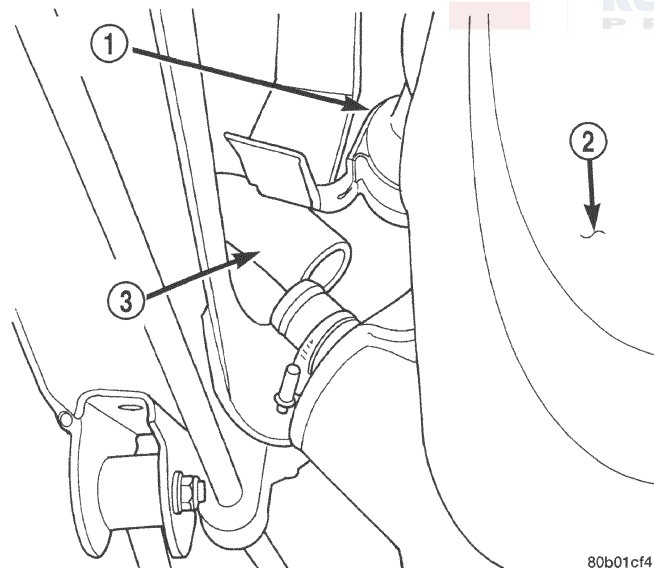
**REMOVAL AND INSTALLATION (Continued)**

(4) Drain fuel tank, refer to Draining Fuel Tank in the Fuel Delivery section (Fig. 11).

**Fig. 11 Fuel Tank Drain**

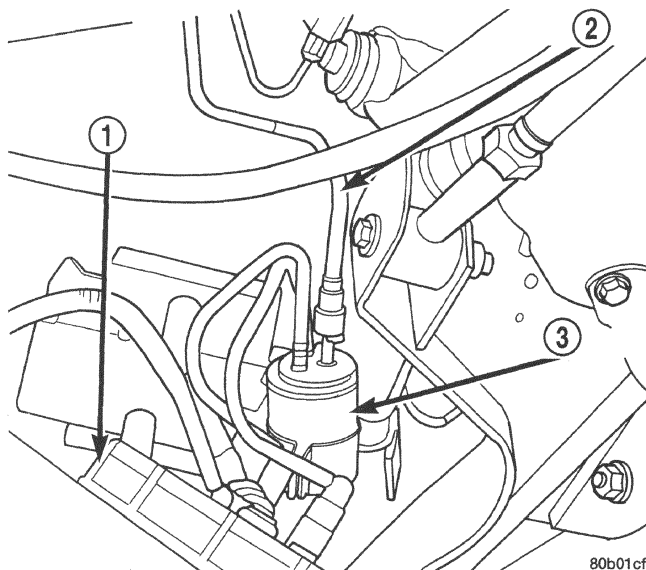
1 - FUEL TANK DRAIN

(5) Loosen and remove fuel filler tube from fuel tank (Fig. 12).

**Fig. 12 Fuel Filler Tube**

1 - FUEL FILTER  
2 - FUEL TANK  
3 - FUEL FILLER TUBE

(6) Disconnect fuel line (Fig. 13).

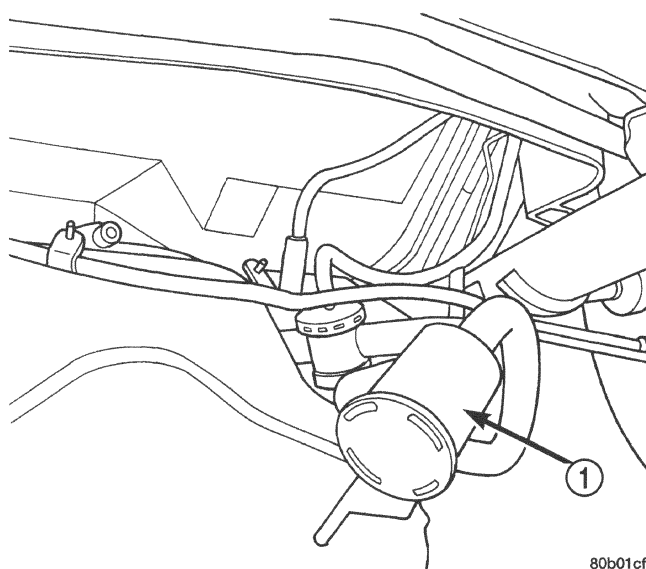
**Fig. 13 Fuel Line**

1 - FUEL PUMP MODULE  
2 - FUEL LINE  
3 - FUEL FILTER

(7) Position transmission jack under fuel tank assembly.

(8) Remove fuel tank straps bolts. Passenger side first.

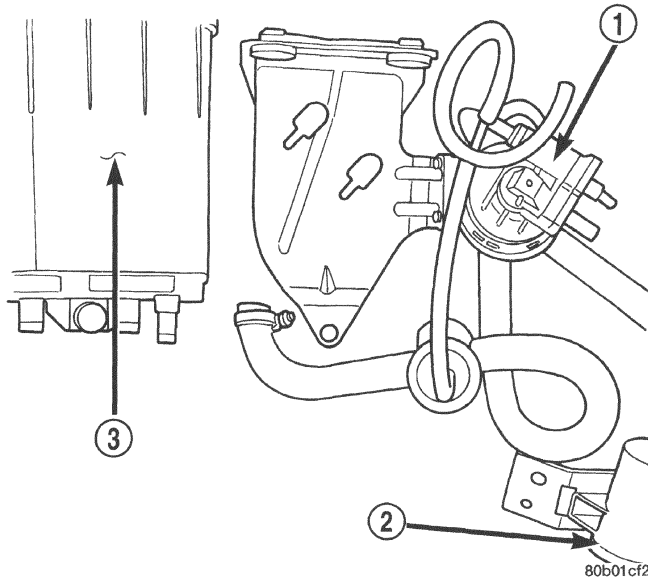
(9) Lower fuel tank and remove the purge line and vent line (Fig. 14).

**Fig. 14 Evap Components**

1 - LDP FILTER

**REMOVAL AND INSTALLATION (Continued)**

- (10) Remove hoses from EVAP canister.
- (11) Disconnect electrical connector for Leak Detection Pump (LDP).
- (12) Remove push pin from bracket for EVAP canister (Fig. 15).

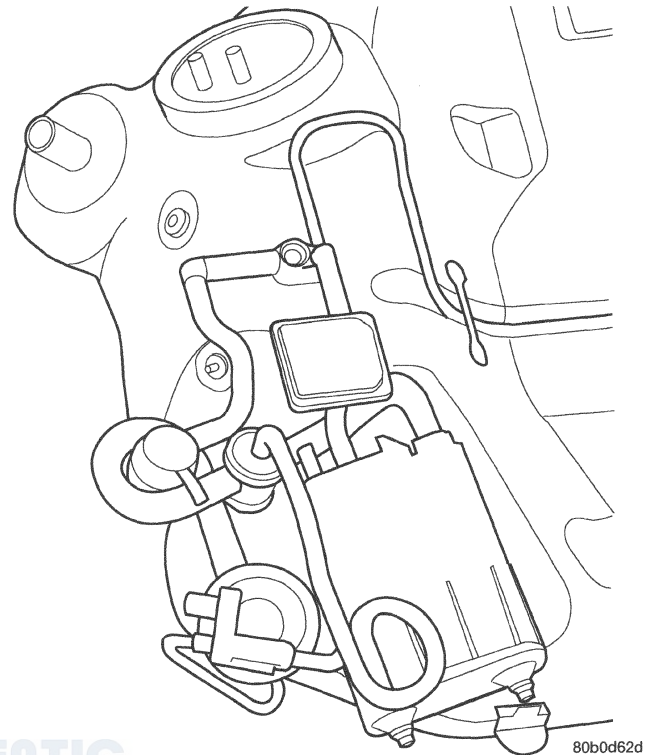
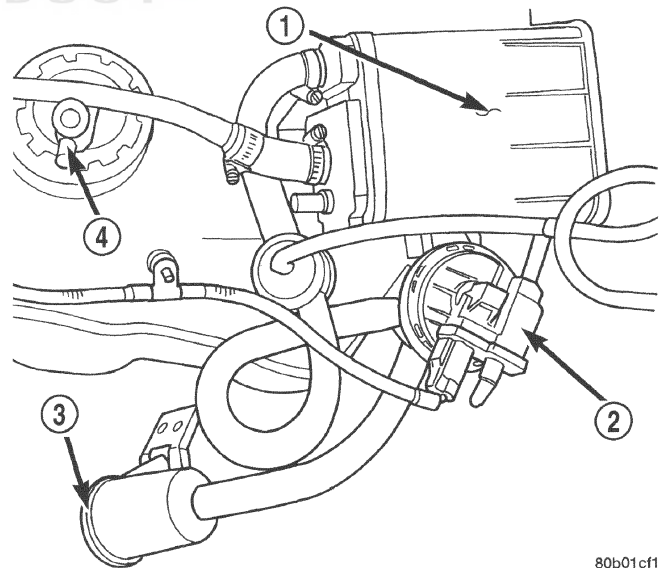
**Fig. 15 LDP and EVAP Canister**

- 1 - LDP
- 2 - LDP FILTER
- 3 - EVAP CANISTER

- (13) Remove bracket and Leak Detection Pump.
- (14) Remove LDP from bracket.

**INSTALLATION**

- (1) Install LDP onto bracket.
- (2) Install bracket and LDP onto fuel tank assembly.
- (3) Install EVAP canister to bracket install push pin.
- (4) Install hoses and lines.
- (5) Raise the fuel tank on the transmission stand.
- (6) Connect the purge and vent lines.
- (7) Connect LDP and fuel pump electrical connector.
- (8) Raise tank into position and install tank straps.
- (9) Install the fuel filler tube and tighten the clamp.
- (10) Lower vehicle.
- (11) Connect the battery cable.
- (12) Fill fuel tank. Use the DRB scan tool to pressurize the fuel system. Check for leaks.

**EVAP CANISTER****Fig. 16 Fuel Tank Assembly****Fig. 17 EVAP System**

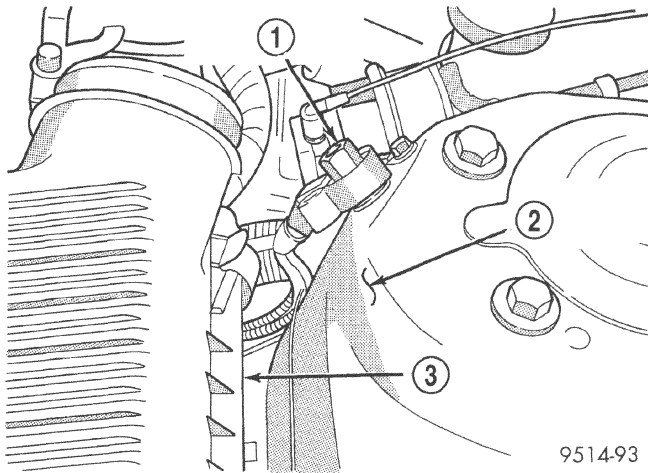
- 1 - EVAP CANISTER
- 2 - LDP
- 3 - LDP FILTER
- 4 - ORVR VALVE



**REMOVAL AND INSTALLATION (Continued)****REMOVAL**

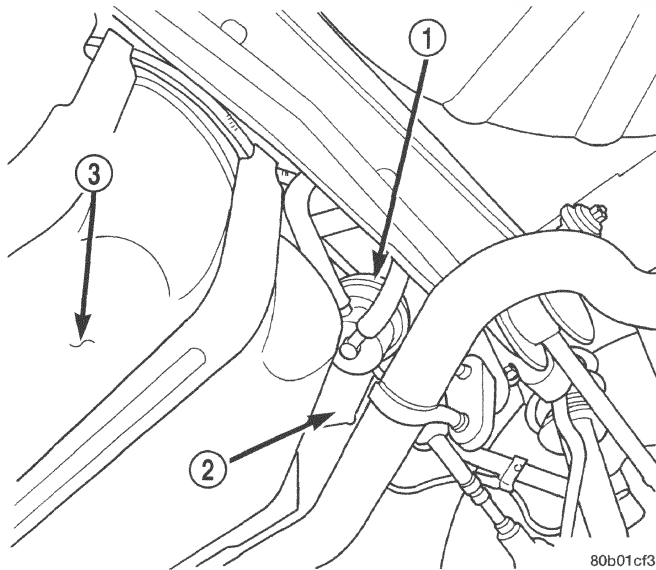
(1) Release fuel pressure, Refer to Fuel System Pressure Release Procedure in the Fuel Delivery section.

(2) Disconnect battery cable (Fig. 18).

**Fig. 18 Battery Cable**

- 1 - AUXILIARY JUMPER TERMINAL
- 2 - LEFT STRUT TOWER
- 3 - AIR CLEANER HOUSING

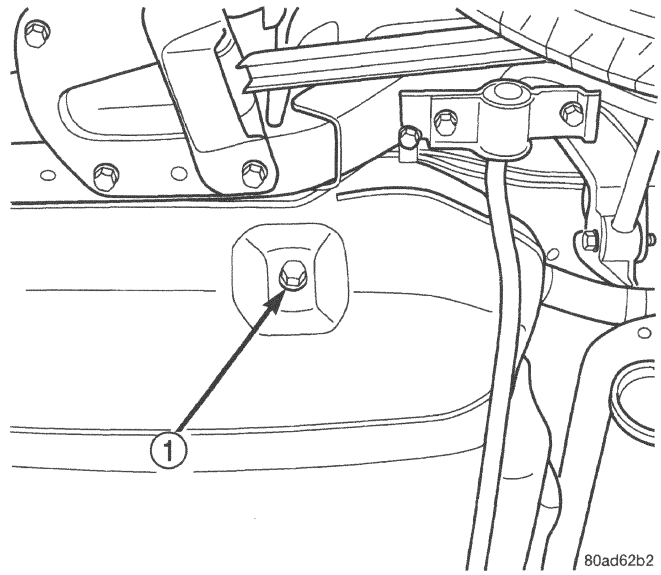
(3) Raise vehicle and support.

**Fig. 19 EVAP System**

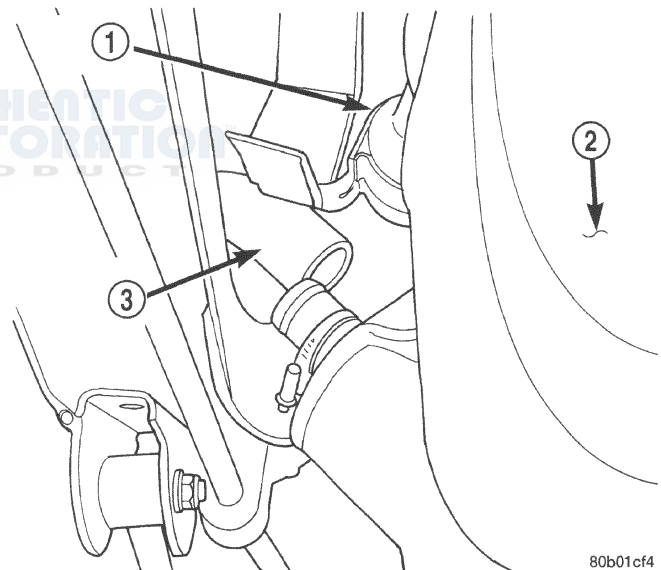
- 1 - LDP
- 2 - EVAP CANISTER
- 3 - FUEL TANK

(4) Drain fuel tank, refer to Draining Fuel Tank in the Fuel Delivery section (Fig. 20).

(5) Loosen and remove fuel filler tube from fuel tank (Fig. 21).

**Fig. 20 Fuel Tank Drain**

- 1 - FUEL TANK DRAIN

**Fig. 21 Fuel Filler Tube**

- 1 - FUEL FILTER
- 2 - FUEL TANK
- 3 - FUEL FILLER TUBE

(6) Disconnect fuel line (Fig. 22).

(7) Position transmission jack under fuel tank assembly.

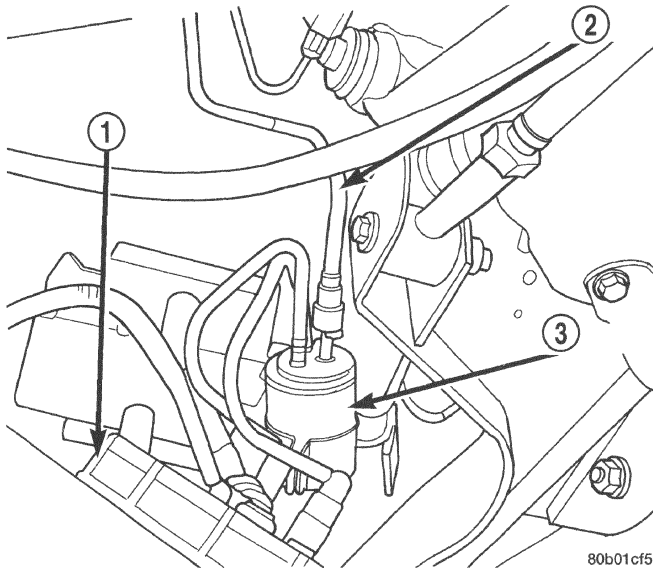
(8) Remove fuel tank straps bolts. Passenger side first.

(9) Lower fuel tank and remove the purge line and vent line (Fig. 23).

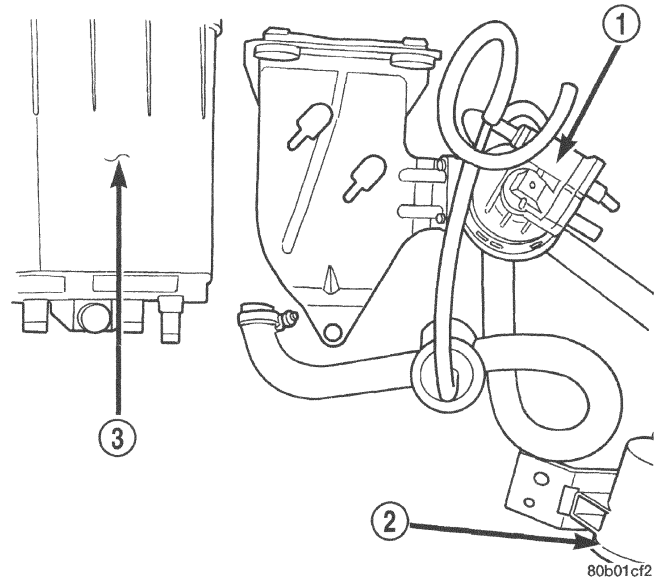
(10) Remove hoses from EVAP canister.

(11) Disconnect electrical connector for Leak Detection Pump (LDP).

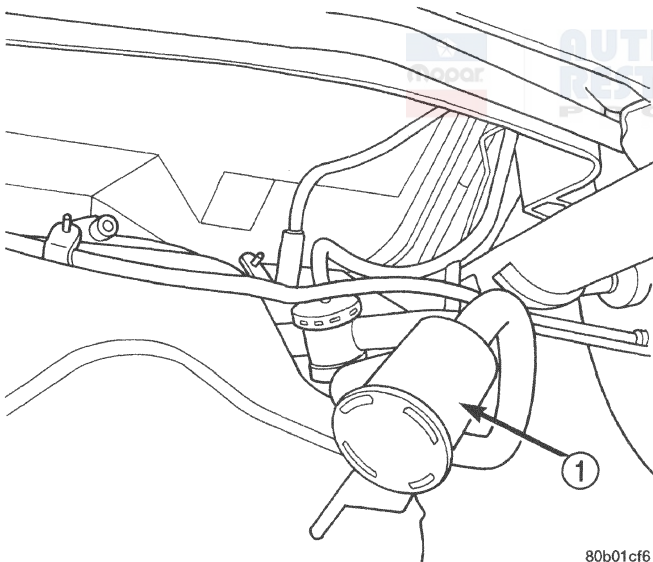


**REMOVAL AND INSTALLATION (Continued)****Fig. 22 Fuel Line**

- 1 - FUEL PUMP MODULE
- 2 - FUEL LINE
- 3 - FUEL FILTER

**Fig. 24 LDP and EVAP Canister**

- 1 - LDP
- 2 - LDP FILTER
- 3 - EVAP CANISTER

**Fig. 23 Evap Components**

- 1 - LDP FILTER

(12) Remove push pin from bracket for EVAP canister (Fig. 24). Remove canister.

**INSTALLATION**

- (1) Install EVAP canister to bracket install push pin.
- (2) Install hoses and lines.
- (3) Raise the fuel tank on the transmission stand.

- (4) Connect the purge and vent lines.
- (5) Connect LDP and fuel pump electrical connector.
- (6) Raise tank into position and install tank straps.
- (7) Install the fuel filler tube and tighten the clamp.
- (8) Lower vehicle.
- (9) Connect the battery cable.
- (10) Fill fuel tank. Use the DRB scan tool to pressurize the fuel system. Check for leaks.

**PROPORTIONAL PURGE SOLENOID****REMOVAL**

- (1) Remove the negative battery cable.
- (2) Remove solenoid from bracket by pulling up on solenoid.
- (3) Disconnect electrical connector from solenoid.
- (4) Disconnect vacuum tubes from solenoid.

**INSTALLATION**

The top of the solenoid has TOP printed on it. The solenoid will not operate unless it is installed correctly.

- (1) Connect vacuum tube to solenoid.
- (2) Connect electrical connector to solenoid.
- (3) Install solenoid on bracket.
- (4) Install the negative battery cable.

# EXHAUST GAS RECIRCULATION (EGR) SYSTEM

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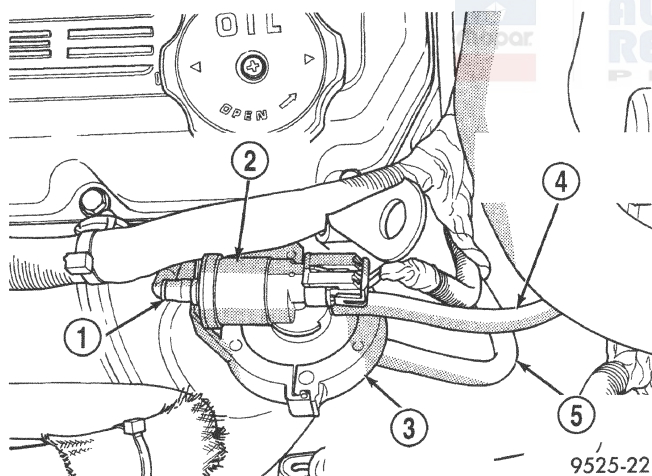
## DESCRIPTION AND OPERATION

### EXHAUST GAS RECIRCULATION (EGR) SYSTEM

#### DESCRIPTION

The EGR system consists of (Fig. 1), and (Fig. 2):

- EGR tube
- EGR valve
- Electric EGR Transducer
- Connecting hoses



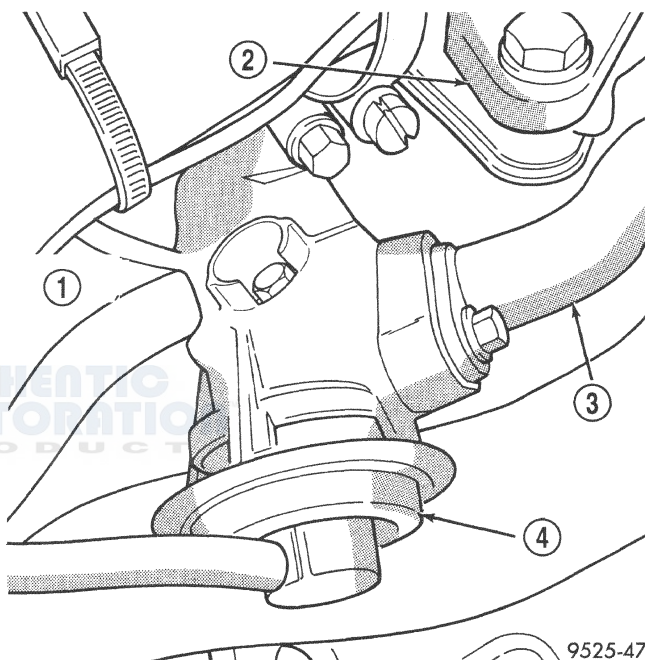
**Fig. 1 EGR Control Valve—2.5L**

- 1 - VACUUM INLET
- 2 - EGR SOLENOID
- 3 - EGR BACK PRESSURE TRANSDUCER
- 4 - VACUUM OUTLET TO EGR VALVE
- 5 - BACK PRESSURE HOSE

#### OPERATION

Refer to Monitored Systems - EGR Monitor in this group for more information.

The EGR system reduces oxides of nitrogen (NOx) in engine exhaust and helps prevent detonation (engine knock). Under normal operating conditions,

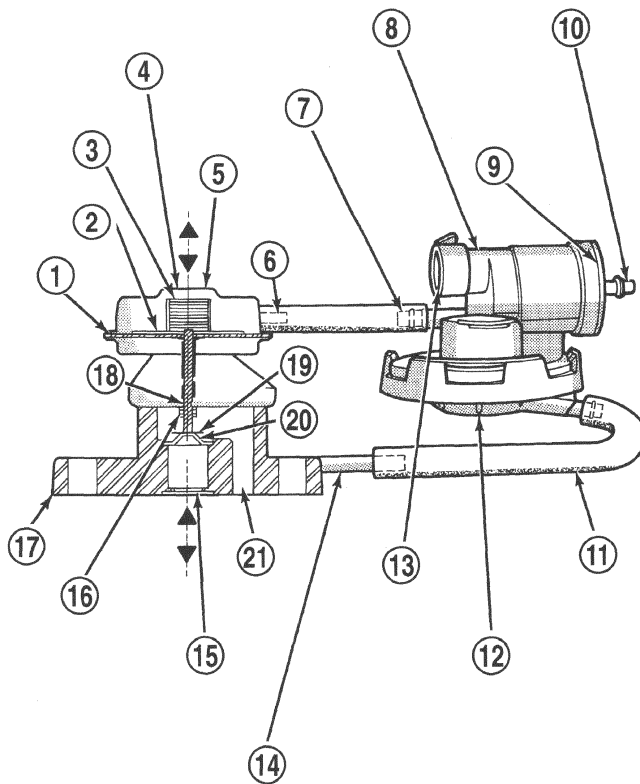


**Fig. 2 EGR Valve—2.5L**

- 1 - EGR VALVE SCREW (2)
- 2 - THERMOSTAT HOUSING
- 3 - EGR TUBE
- 4 - EGR VALVE

engine cylinder temperature can reach more than 3000°F. Formation of NOx increases proportionally with combustion temperature. To reduce the emission of these oxides, the cylinder temperature must be lowered. The system allows a predetermined amount of hot exhaust gas to recirculate and dilute the incoming air/fuel mixture. The diluted air/fuel mixture reduces peak flame temperature during combustion.

The electric EGR transducer contains an electrically operated solenoid and a back-pressure transducer (Fig. 3). The Powertrain Control Module (PCM) operates the solenoid. The PCM determines when to energize the solenoid. Exhaust system back-pressure controls the transducer.

**DESCRIPTION AND OPERATION (Continued)****Fig. 3 Electric EGR Transducer**

- 1 - DIAPHRAGM
- 2 - PISTON
- 3 - SPRING
- 4 - EGR VALVE ASSEMBLY
- 5 - VACUUM MOTOR
- 6 - VACUUM MOTOR FITTING
- 7 - VACUUM OUTLET FITTING TO EGR VALVE
- 8 - EGR VALVE CONTROL ASSEMBLY
- 9 - ELECTRIC SOLENOID PORTION OF VALVE CONTROL
- 10 - VACUUM INLET FITTING FROM ENGINE
- 11 - BACK-PRESSURE HOSE
- 12 - TRANSDUCER PORTION OF VALVE CONTROL
- 13 - ELECTRICAL CONNECTION POINT
- 14 - EGR VALVE BACK-PRESSURE FITTING
- 15 - EXHAUST GAS INLET
- 16 - STEM PROTECTOR AND BUSHING
- 17 - BASE
- 18 - MOVEMENT INDICATOR
- 19 - POPPET VALVE
- 20 - SEAT
- 21 - EXHAUST GAS OUTLET

When the PCM energizes the solenoid, vacuum does not reach the transducer. Vacuum flows to the transducer when the PCM de-energizes the solenoid.

When exhaust system back-pressure becomes high enough, it fully closes a bleed valve in the transducer. When the PCM de-energizes the solenoid and back-pressure closes the transducer bleed valve, vac-

uum flows through the transducer to operate the EGR valve.

De-energizing the solenoid, but not fully closing the transducer bleed hole (because of low back-pressure), varies the strength of vacuum applied to the EGR valve. Varying the strength of the vacuum changes the amount of EGR supplied to the engine. This provides the correct amount of exhaust gas recirculation for different operating conditions.

This system does not allow EGR at idle.

A failed or malfunctioning EGR system can cause engine spark knock, sags or hesitation, rough idle, engine stalling and increased emissions.

**REMOVAL AND INSTALLATION****EGR VALVE AND TRANSDUCER—2.5L**

If the EGR system operates incorrectly, replace the entire EGR valve and transducer together. The EGR valve and electrical transducer are calibrated together. The EGR valve attaches to the front exhaust manifold. The transducer/solenoid attach to the front cylinder head.

**REMOVAL**

- (1) Remove the negative battery cable.
- (2) Disconnect vacuum supply from solenoid.
- (3) Disconnect electrical connector from solenoid.
- (4) Remove screws holding transducer to bracket.
- (5) Remove screws holding Transmission Control Module (TCM) to bracket (Fig. 4). Swing TCM up to allow access to EGR screws (Fig. 5).
- (6) Remove screws holding EGR tube.
- (7) Remove EGR valve mounting screws. Remove EGR valve and transducer.
- (8) Clean gasket surfaces. Discard old gaskets. If necessary, clean EGR passages.

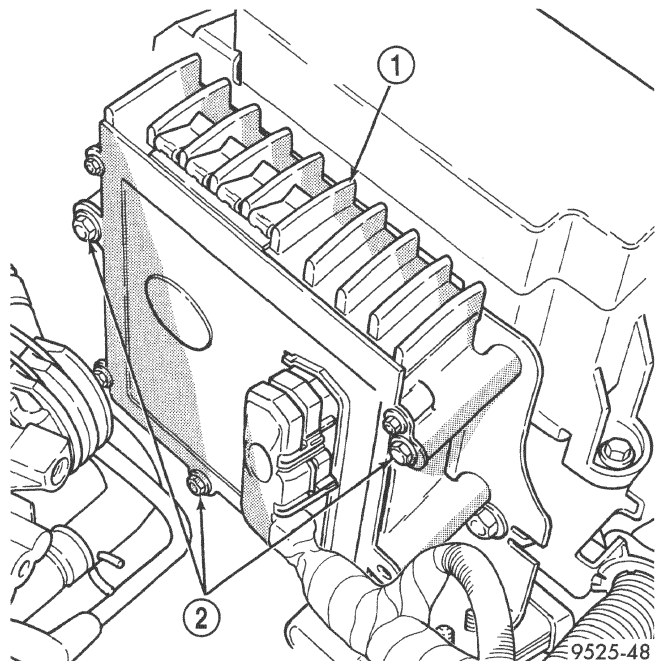
**INSTALLATION**

- (1) Loosely install EGR valve with new gaskets.
- (2) Finger tighten EGR tube fasteners.
- (3) Tighten EGR valve mounting screws to 22 N·m (200 in. lbs.) torque.
- (4) Tighten EGR tube fasteners to 11 N·m (95 in. lbs.) torque.
- (5) Install transducer to bracket.
- (6) Connect vacuum supply to solenoid.
- (7) Attach electrical connector to solenoid.
- (8) Install the negative battery cable.

**EGR TUBE—2.5L**

The EGR tube attaches to the intake manifold plenum behind the throttle body and to the EGR valve.

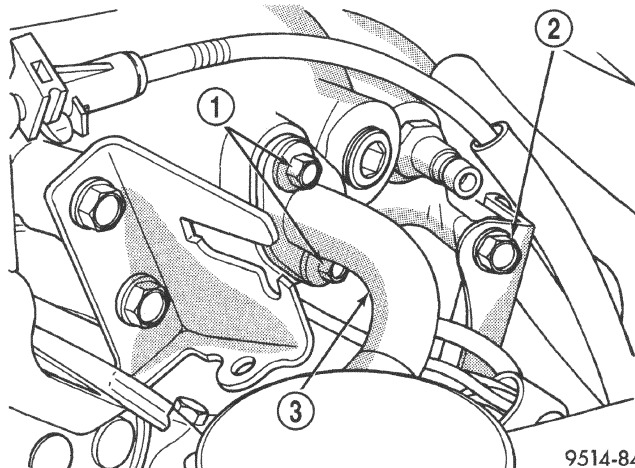


**REMOVAL AND INSTALLATION (Continued)****Fig. 4 TCM Removal**

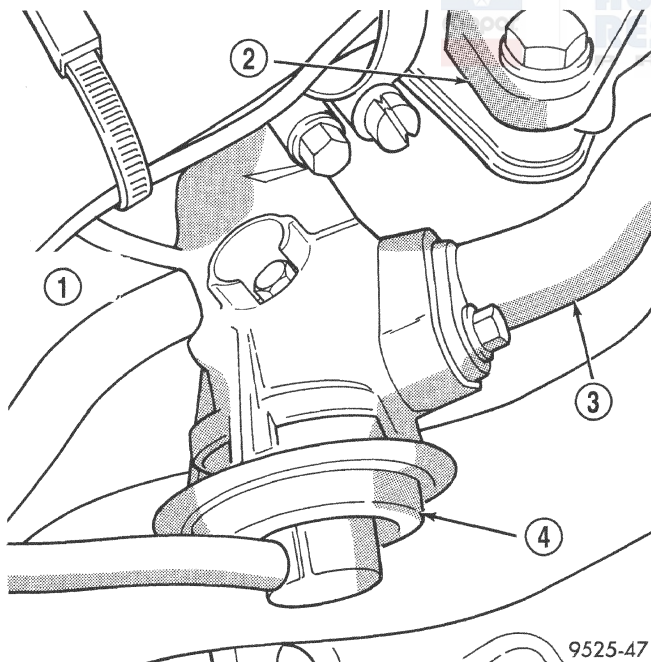
- 1 - TRANSMISSION CONTROL MODULE (TCM)
- 2 - ATTACHING SCREWS

**REMOVAL**

- (1) Remove the negative battery cable.
- (2) Remove the air cleaner cover and hose.
- (3) Remove screws attaching EGR tube to intake manifold (Fig. 6).

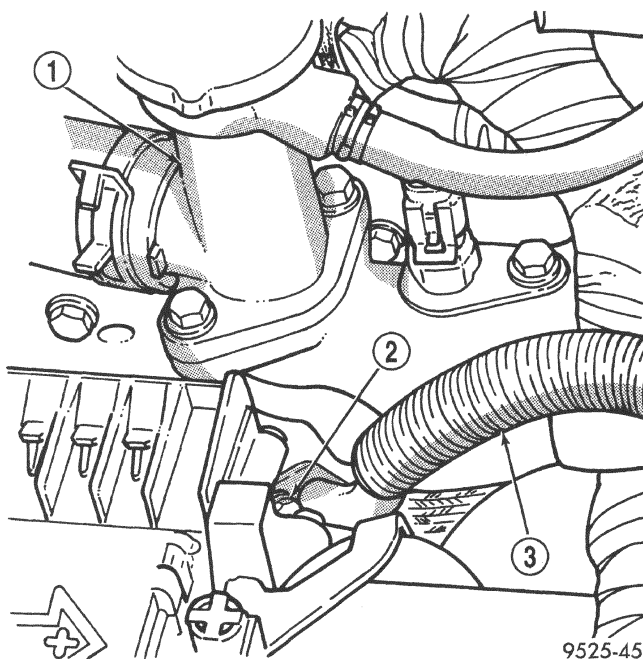
**Fig. 6 EGR Tube at Intake Manifold**

- 1 - EGR TUBE BOLTS
- 2 - SUPPORT BRACKET BOLT
- 3 - EGR TUBE

**Fig. 5 EGR Removal**

- 1 - EGR VALVE SCREW (2)
- 2 - THERMOSTAT HOUSING
- 3 - EGR TUBE
- 4 - EGR VALVE

- (4) Remove EGR tube to EGR valve screws (Fig. 7).

**Fig. 7 EGR Tube at EGR Valve**

- 1 - COOLANT FILL NECK
- 2 - EGR TUBE BOLTS (2)
- 3 - EGR TUBE



## REMOVAL AND INSTALLATION (Continued)

(5) Remove EGR tube. Discard old gasket. If necessary clean EGR passage.

### INSTALLATION

Use new gaskets on both ends of the EGR tube.

- (1) Loosely install the EGR tube and fasteners.
- (2) Tighten the EGR tube to intake manifold plenum screws to 11 N·m (95 in. lbs) torque.
- (3) Tighten the EGR tube to EGR valve screws to 11 N·m (95 in. lbs.) torque.
- (4) Install the air cleaner cover and hose.
- (5) Install the negative battery cable.

## SPECIFICATIONS

### TORQUE

Description	Torque
EGR valve to cyl. head . . . . .	22 N·m (200 in. lbs.)
EGR tube to EGR valve . . . . .	11 N·m (95 in. lbs.)
EGR tube to intake manifold . .	11 N·m (95 in. lbs.)



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PRODUCT

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